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Two fast runs on the New York Central R. R. were made Sept. 24. Engine No. 999, with two cars, made the trip from Albany to Syracuse, 148 miles, in 135 minutes, no intermediate stop being made. This gives an average speed of 66 miles per hour. The train left New York about 3 a. m., and left Albany (143 miles) at 5:58 a. m., arriving at Syracuse at 8:13 a. m. From Albany to the Syracuse tunnel the average time is given as 67.3 miles per hour. This train was a special, carrying the New York "Times" to the Democratic convention, and was followed by another carrying the "World." The second train left New York at 3:25 a. m.; Albany, 1.22, and arrived at Syracuse at 8:44 the later part of the run being made in 136 minutes, or at about the same speed as that of the first train. The average speed for the 291 miles from New York to Syracuse, including the one stop at Albany, in each case, were about 54.74 and 55.81 miles per hour, respectively. On Sept. 25 a special train carrying the "World" left New York at 3:15 a. m., and arrived at Syracuse at 8:07 a. m., or 291 miles in 292 minutes, including one stop at Albany. The 148 miles from Albany to Syracuse was covered in 130 minutes, or at 68.2 miles per hour.

A railway run of 299¼ miles without stopping was made recently by the London & Northwestern Ry. between London and Carlisle. The run was made with a special train, consisting of two day cars, two sleeping cars, and a brake van, weighing about 112 gross tons, and hauled by one of the older three-cylinder compounds. The trip was made in 5 h. 53 min., the speed averaging 51 miles per hour. The previous English record for a run, without stopping or changing engines, was from London to Crewe, 158 miles, but in this country the record is 439½ miles, between New York and Pittsburg, on the Pennsylvania R. R., while runs of 100 to 150 miles, without stop, are of everyday occurrence.

The new East River Bridge project seems to be seriously handicapped by the sweeping franchise of the Uhlman Company, and Commissioner Henry Batterman states that it may be necessary, after all, to institute condemnation proceedings against the old franchise, with all the delay and cost that this may mean. The borings which the new commission have instituted seem to indicate that this must be done, as the docks of the Havemeyer sugar refineries interfere with the best available site. The commission, and its Chief Engineer, Mr. L. L. Buck, M. Am. Soc. C. E., have opened offices at No. 392 Kent Ave., Brooklyn.

The pollution of the Passaic River from Paterson, N. J., to its outlet into Newark Bay, was discussed by a conference of representatives of the communities affected in conjunction with the State Board of Health at Trenton, on Sept. 20. The sewage of Paterson, Passaic, a part of Newark, and a number of lesser municipalities discharges into the river. As the Passaic is a tidal stream, the sewage is bandied back and forth, and the accumulated sludge is exposed at each low tide. The conference ended with an understanding that a committee should be appointed to frame a bill for introduction in the next legislature, which bill shall provide for an abatement of the nuisance.

The most serious railway accident of the week was the wreck of a freight train near Bonnieville, Ky., on the Louisville & Nashville R. R., Sept. 16. The train consisted of 26 cars, and the front truck of one of the middle cars left the rails. Several cars were smashed, and a brakeman was killed, while two tramps were badly injured.

A train carrying troops from the recent military manoeuvres in Germany ran into a freight train standing on the track at Oederan. There were 12 men killed and about 60 injured.

The Spanish cruiser "Sanchez Barcaiztegui" sank in the harbor at Havana, Cuba, at about midnight on Sept. 19, after being struck by the incoming coasting steamer "Mortera," and nearly 40 of the officers and crew were drowned. The cruiser was of iron, barque rigged, carried seven guns, and was built at La Seyne in 1876. There were eight officers and 160 men on board. The cruiser was going out of the harbor, and the "Mortera" mistook the whistle signals and went to starboard instead of to port. The boilers are said to have exploded.

The steamer "Edam," of the Netherlands-American Line, was struck by the steamer "Turkestan," of the Anglo-Arabian & Persian Line, off Start Point, in the English Channel, on Sept. 19, and sank shortly after, but all of the 47 passengers and 42 officers and crew were saved, going off in the boats of the "Edam," which were taken in tow by a fishing boat and a steamer. The weather was foggy, and the collision occurred in the early morning in a part of the channel which is a regular route for transatlantic steamers. The "Edam" was an iron, brig-rigged steamer of 3,000 tons, built in 1883, and carried steerage passengers only, being a slow steamer. It left New York Sept. 5 for Amsterdam. The "Turkestan" is 345 ft. long, 47 ft. beam, 4,000 gross tonnage, and was built in 1894.

Railway schedules in North Carolina are under the control of the State Board of Railroad Commissioners, and that Board has ruled that the Southern Ry. Western "cannon-ball" express shall connect with the Seaboard Air Line southbound "Atlanta special" at Raleigh, N. C. Formerly the Southern Ry. train left Raleigh (which is its starting point) five minutes before the arrival of the Seaboard Air Line train from Washington, compelling passengers for western North Carolina to stop over at Raleigh from 5 a. m. to 4 p. m.

The builders or inventors of "horseless carriages" in the United States are specially invited to attend the "Good Roads" parliament, to be held at Atlanta, Ga. Gen. Roy Stone, Chief of the Office of Road Inquiry of the Department of Agriculture, writes us that he desires to be placed in communication with all those engaged in the development of such vehicles, and will be glad to be informed of their names and addresses.

The cost of the proposed Boston subway tunnel beneath the harbor to East Boston has been estimated as $2,406,600 by Mr. Howard Carson, M. Am. Soc. C. E., Chief Engineer of the Boston Rapid Transit Commission. This estimate is based on an open incline from a point on Hanover St., descending 5 ft. per 100 to an unstated depth. From the foot of the incline a single tube subway, suitable for a double-track in open trench would extend for an unstated distance. Then two tubes, each 12 ft. wide and 16 ft. high, inside measurement, would be laid beneath the harbor on a nearly level plane, the outside of the tubes to be nowhere less than 35 ft. below low water. Each of these tubes would be wide enough for an ordinary surface car, with a narrow walk on each side for use in case of stoppages. This part of the work, Mr. Carson states, could be built by dredging and putting in the tubes in 50-ft. sections, as was done on the Shirley Gut siphon of the metropolitan sewer (see Eng. News, May 3, 1894). The incline on the East Boston side would be similar to that at the other end. The total length of the tunnel and inclines would be 4,775 ft., and its estimated cost $2,052,000, to which must be added $354,000 for land damages.

The preliminary surveys and estimates for the Lake Erie and Ohio River ship canal, and the general feasibility of the project, are to be submitted to a commission composed of Gen. H. L. Abbot, Corps of Engineers, U. S. A., retired; Mr. N. H. Hutton, late Chief Engineer of the Harbor Board of Baltimore, and Prof. Lewis M. Haupt, late of the University of Pennsylvania, and deeply interested in ship-canal projects. The two last-named engineers recently reported upon the proposed ship canal between Philadelphia and New York.

Damages for sickness and depreciation of the rental value of property through the pollution of a small stream by sewage have been awarded against the village of St. Albans, Vt., by a county court jury. The plaintiff owned a house located within 20 ft. of a stream known as Stevens Brook, which has been used for years, it is alleged, as a natural conduit for the sewage of the village. Between May, 1893, when the plaintiff bought the house, and March, 1895, when he brought suit against the village, the plaintiff stated that there has been an obstruction in the brook near his house which caused the sewage to stand there, accumulating on the banks and giving off foul odors. This nuisance, he alleged, caused sickness in his family, with attendant expense, and lessened the rental value of his house and obliged him to take in an undesirable tenant. The jury awarded damages to the amount of $533.

Bids for constructing the regulating works at the outlet of the Chicago Drainage Channel will be received until Nov. 20, as noted in our advertising pages. These works are to be erected on Section 15 of the canal, and their purpose is to regulate and control the flow of water from the main channel into the tail race leading to the Desplaines River. Briefly described, they will consist of a bear-trap dam of iron and steel, 100 ft. wide on the crest, and seven sluice gates, all supported by masonry abutments and piers, together with the necessary operating machinery. Specifications and plans for the work can be seen at the office of the Chief Engineer, Rialto Building, Chicago.

An ordinance authorizing an elevated railway to be constructed along Wabash Ave. from Lake St. to Harrison St., in the business district of Chicago, has been introduced into the City Council by the Union Elevated R. R. Co. of that city. The line is a part of a proposed loop line intended to connect the four elevated railway lines entering the business district of Chicago, and to afford them improved terminal facilities. The ordinance calls for a two-track structure, with latticed girders and an open floor carried on columns placed no more than 3½ ft. outside of the street car tracks, and requires the use of electric power, or some equally clean and noiseless motive power, except in the case of the Chicago & South Side Rapid Transit line, which will be allowed to continue the use of steam locomotives for a period of three years. All cross streets not over 70 ft. wide are to be crossed with a single span. The columns are to be 35 ft. apart longitudinally, on tangents, and a minimum clear headway of 14 ft. is to be allowed at all points. All of the superstructure, except the track rails and ties, is required to be of wrought iron. One fare of 5 cts. is to be charged, the loop line being regarded as a part of the continuous line of each road using it. The city is to receive a license fee of $50 per car annually from the company. The most notable clause in the ordinance is that calling for the use of wrought iron instead of steel, this clause being all the more curious from the fact that steel has been used entirely in the construction of the various railways which are building the loop. The ordinance also practically puts an end to the use of steam locomotives on Chicago's elevated railways, as three of the roads which will use the loop are now, or soon will be, operated by electric power, while the life of steam power on the fourth line is limited to three years.

Filling in trestles by sluicing is being practised with success on the Cascade Division of the Northern Pacific R. R. A powerful water jet from a monitor, as used in placer mining, breaks down the material of the hill, and washes it down through flumes. Longitudinal planks are laid, on small banks or ridges of earth mixed with straw and hay built along the slope of the fill as it progresses, so as to arrest the material washed down, the top of the ridge being kept about 12 ins. above the surface, the water flowing over the ridge. The material is directed to any desired part of the work by planks fitted with braces so that they stand on edge. The work is said to cost only about 5 cts. per cu. yd. of bank.

Electric signals have been erected by the Coney Island & Brooklyn Electric R. R., of Brooklyn, N. Y., at its crossing of the Boulevard and bicycle path. There are three electric lights over the roadway and two over the path, all having red globes, and when a car reaches a point 25 ft. from the crossing it operates a track instrument which sends the current through the signal lamps, and also rings a gong warning the motorman to come to a full stop before reaching the crossing.

Proposals for the construction of battleships Nos. 5 and 6 are called for by the Secretary of the Navy, and are to be opened on Nov. 30, 1895. These will be two sea-going coast-line battleships of about 10,000 tons displacement each. An average speed of 16 knots per hour for four successive hours must be developed with an air pressure in the fire-room not exceeding 1 in. of water. If only an average speed of 15 knots is made, they will be accepted at a reduced price, at the rate of $100,000 per knot. If the speed falls below 15 knots, the Secretary may or may not accept the ships, at a price agreed upon. All expenses of all trials prior to acceptance must be borne by the contractors, and there is no premium on speed over 16 knots. All parts of the ships shall be of domestic manufacture, and they must be completed within three years.

Lead poisoning from the service pipes of the waterworks of Kingston, Mass., is alleged to have caused much sickness of late, but no deaths, as yet. The supply is taken from springs. The matter is being investigated by the State Board of Health.

THE NEW UNITED STATES GOVERNMENT LOCK AT SAULT STE. MARIE, MICH.

I.

(With Inset.)

The 800 × 100-ft. ship-canal lock, which has been under construction by the United States Government at Sault Ste. Marie, Mich., since 1887, will probably be completed ready for traffic by the end of the present year. This is, as most of our readers doubtless know, the largest canal lock in the world, and will, in connection with the deepening of the Detroit and St. Mary's rivers, give the United States an independent waterway 20 ft. deep from Buffalo, N. Y., to Duluth, Minn. The size of the lock has naturally called for unusual dimensions in all its working parts, but in addition to this the immense traffic to be provided for has demanded unusual certainty in the rapid and reliable operation of these parts, thus making their design a problem requiring the most careful consideration. In the short series of articles which is begun herewith, we shall describe and illustrate these various structural features in such detail as their importance seems to warrant.

The construction of the lock and the various improvements made in connection with it is a part of the work which the United States Government is doing to secure a navigable channel 20 ft. deep between the different ports of the Great Lakes. While any detailed review of this work is impossible here, it is desirable to touch briefly upon the work in the St. Mary's River, which was a necessary concomitant of the deeper and larger lock. An outline map of a portion of the St. Mary's River is shown in Fig. 1. The old 16-ft. channel passed east and north of Sugar Island through Lake George, practically on the international boundary line between Canada and the United States. When it was decided to increase the navigable depth of the river route to 20 ft., the Government engineers concluded to open up an entirely new route through Hay Lake, which, in addition to being well within United States territory, was considerably shorter, and required less excavation than the Lake George route. Both the old and new channels are shown on the map, which also shows by means of the 20-ft. contour the relative lengths of channel requiring to be dredged in each case. The dredged channel is 300 ft. wide, and as stated above is 20 ft. deep. The most of the excavation was in earth, but a very considerable proportion was in hard limestone rock, which had to be broken by blasting.

The canal proper carries the channel around the St. Mary's Rapids, where the waters of Lake Superior fall 18 ft. to the level of Lake Huron and Lake Michigan. These rapids are 3,500 ft. long and 2,300 ft. wide, and the average depth of the water is about 2½ ft., with a boulder-strewn rock bottom. They are navigable only by the canoes of the half-breeds who add to their incomes as guides to sportsmen by aiding and abetting the excitement-loving tourist in risking his life by "shooting the rapids." The canal is on the south side of the rapids, cutting off the extreme northern point of the Southern Michigan peninsula, and directly across the river is the old Canadian ship canal and lock described in our issue of March 28, 1895.

Old Locks.

The lock now under construction is the third to be built on the American side of the rapids. The first canal and locks were built by the state of Michigan, and were afterward taken over by the Federal Government. Work on the old state locks was begun in 1853 and completed in May, 1855. There were two locks, each 350 ft. long and 70 ft. wide. The depth of water on the sills were 11½ ft., and the lifts were 9 ft. each, or 18 ft. altogether. The walls were of limestone masonry. The floor consisted of 12 × 12-in. longitudinal sills, bolted to the solid rock foundation bed, and capped by 12 × 12-in. transverse timbers, also bolted to the rock. All interstices were filled in with gravel firmly rammed. On the top of the transverse timbers was spiked a flooring of 3-in. plank. The gates were of wood, and water was admitted to the lock chamber through them by means of butterfly valves worked by a rack and pinion. The leaves of the gates were worked by booms, which were moved backward and forward by means of hand capstans and wire ropes. The cost of this lock was $999,802.

The first contract for the second lock which is now in use, known as the lock of 1881, was let Oct. 20, 1870, but the first stone was not laid until July 25, 1876, and the work was completed in 1881. The length of the canal is 7,000 ft., its depth 16 ft., and it has a variable width, its least width being 108 ft. In constructing the canal a cofferdam was built around the excavation, and the earth was taken out with dredges. The dimensions of the lock are as follows:

Length between hollow quoins	515 ft.
Width at body	80 "
Width at gates	60 "
Depth on sill	17 "
Lift	18 "
Capacity	1,500,000 cu. ft.

The walls of the lock are founded on rock, and are built of limestone masonry, there being 34,207 cu. yds. of masonry altogether. The culvert floor consists of 12 × 12-in. longitudinal sills laid 10 ft. apart, and capped by 12 × 12-in. transverse timbers laid 6 ins. apart and bolted through the sills to solid rock. All interstices are filled with concrete. Two courses of 3 × 6-in. plank are spiked to the transverse timbers. On the top of this flooring came the walls of the culverts, by which water is admitted to the lock chamber, and on these walls are the 12 × 12-in. transverse timbers placed 6 ins. apart, to which the lock floor is spiked.

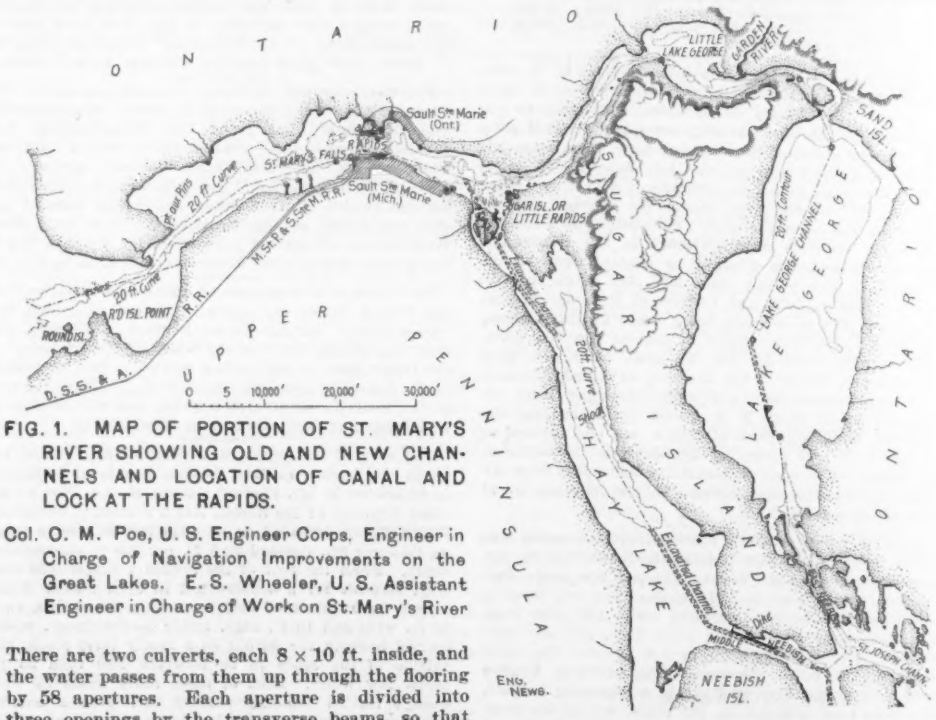

FIG. 1. MAP OF PORTION OF ST. MARY'S RIVER SHOWING OLD AND NEW CHANNELS AND LOCATION OF CANAL AND LOCK AT THE RAPIDS.

Col. O. M. Poe, U. S. Engineer Corps, Engineer in Charge of Navigation Improvements on the Great Lakes. E. S. Wheeler, U. S. Assistant Engineer in Charge of Work on St. Mary's River

There are two culverts, each 8 × 10 ft. inside, and the water passes from them up through the flooring by 58 apertures. Each aperture is divided into three openings by the transverse beams, so that in reality there are 174 openings 6 × 24 ins. for the passage of water. The valves have cast iron frames and axles and boiler iron sheathing, and the gates are of wood. There are four valves, two for filling and two for emptying, each measuring 8 × 10 ft. There are also four gates—viz., one lock and one guard gate at each end. The frames of the gates are of oak, and the sheathing of Norway pine. Both guard gates are operated by a temporary block and tackle, and the upper guard gate has valves for admitting water to the canal. The power for operating the gates and valves is obtained from two 30-in. turbines, to which water is brought from the upper level by a 36-in. supply pipe. These turbines operate pumps pumping into accumulators, from which the water is taken to operate the hydraulic valve and gate engines—eight in number—one for each gate leaf and each valve. As already stated, this lock was completed in 1881, and it has been in constant operation ever since. By its construction a 16-ft. channel was secured the entire length of the Great Lakes.

The 800-ft. Lock.

The 16-ft. channel between Lakes Superior and Michigan had been barely completed when the demands of commerce so enormously increased that the work of attaining a depth of 20 ft. throughout was undertaken by the government. A necessary part of this project was the construction of a new lock, and after full consideration, Col. O. M. Poe, the U. S. Engineer in charge of the improvement of navigation on the Great Lakes, decided to build this lock alongside the lock of 1881 and on the site of the old state locks. It was also decided to make this lock 800 ft. long and 100 ft. wide, with a depth of 21 ft. on the sill and a lift of 18 ft. The relative location and size of the new and old locks are shown in Fig. 2. The estimated cost of the lock was $4,738,865. The drawings on the inset sheet show various plans and sections of the 800-ft. lock, and largely explain themselves.

Excavating Lock Pit.—The new lock being located on the site of the old state locks, the first work necessary was the removal of the old structure and the deepening and widening of the excavation and the rock removed by derricks and tram-constructed, entirely closing the proposed excavation and the rock removed by derricks and tram cars. Fig. 3 shows the appearance of the excavation when practically completed. The amounts of material excavated were 130,085 cu. yds. of earth and 106,602 cu. yds. of solid rock, and the costs were 43 cts. per cu. yd. and $1.33 per cu. yd., respectively. The only difficulty encountered in the work of excavation was due to a leak in the cofferdam, which flooded the lock pit and delayed the work considerably.

The cause of this leak was found to be a crevice in the rock passing underneath the cofferdam, and despite all efforts to close it, the flow of water rapidly enlarged the break, until about 50 ft. of the clay in the cofferdam had been washed away. The large break was closed by driving additional sheet-piling and filling in with brush, hay and clay in sacks. This, however, failed to entirely stop the leak through the crevice, and it was determined to fill the cavity with clay. For this purpose a 3-in. pipe was driven down through the cofferdam until its lower end penetrated the crevice. In this pipe small cylinders of clay about 1 ft. long were placed and forced down into the cavity by means of a plunger working in the pipe. The apparatus is shown in Fig. 4. As will be seen the plunger, or rammer, is an iron rod to the top of which is fastened a block of wood sliding between the guides of an ordinary pile driver. The hammer of the pile driver is the weight which pushes down the rammer. This apparatus was designed by Mr. E. S. Wheeler, Engineer in Charge of the work, and was used not only to fill this

crevice, but all along the cofferdam for the purpose of compacting the clay filling. The illustrations show the method of operation so clearly that no further description is required except to say that the apparatus proved most successful for the purpose for which it was intended.

Lock Masonry.—The total volume of masonry in the lock proper is 80,876 cu. yds., of which 23.1% is cut stone masonry, 59.7% backing and 17.2% mortar. The contractors for this portion of the work were Hughes Bros. & Bangs, and they began constructing and erecting their plant in May, 1891. The first concrete for the foundation was laid June 24, and the first stone was laid Sept. 2, 1891.

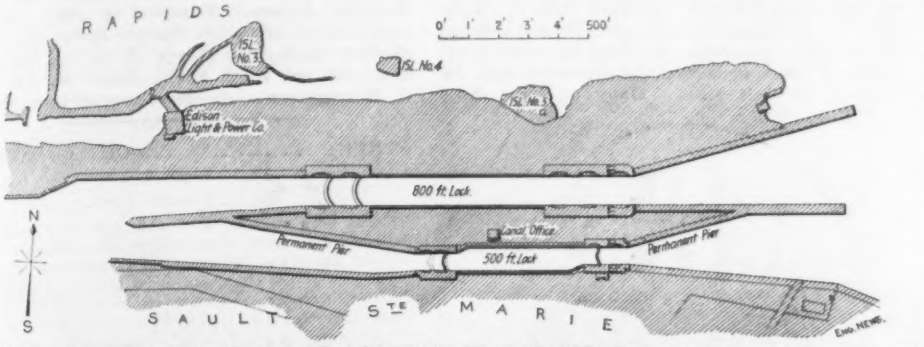

FIG. 2. GENERAL PLAN SHOWING LOCATION OF THE PRESENT 500-FT. LOCK AND THE NEW 800-FT. LOCK AT SAULT STE. MARIE, MICH.

Concrete.—The stone used for the concrete was the red sandstone from the lock pit, and was crushed to pass through a 2-in. ring. All the dust and small pieces were screened off and the remainder thoroughly washed. The sand was a clean, sharp quartzose sand pumped from the bottom of the river at Point aux Pins. The cement used was Milwaukee natural cement, tested according to the system recommended by the Committee of the American Society of Civil Engineers. Full details of these tests will be given in another article. The composition of the concrete for the foundations was 1 cement, 1½ sand and 4 broken stone. The process of mixing was as follows: A batch consisted of 5¼ cu. ft. of cement, 7.88 cu. ft. of sand and 21 cu. ft. of broken stone. A layer of sand was first spread evenly over the bottom of the mixing box and the cement spread on top of it, and the whole thoroughly mixed dry. Water was then added, and the whole mixed to a rather stiff mortar. The stone was then added and mixed with the mortar. The concrete was then shoveled directly into place and rammed in 8-in. layers. No concrete was permitted to be laid during freezing weather.

It was found from tests carefully made that 5.48 cu. ft. of natural cement, 8.22 cu. ft. of sand and 2.93 cu. ft. of water when carefully mixed, made 9.8 cu. ft. of mortar, and this, mixed with 21.9 cu. ft. of broken stone, made about 23.5 cu. ft. of concrete when rammed. With the exception of the floor and walls of the pump well and the pump well culvert, which were of Portland cement concrete, all the concrete was made with Milwaukee natural cement. When Portland cement was used the composition of the concrete was 1 cement, 2 sand and 4 broken stone. With this composition 5¼ cu. ft. of cement, 10½ cu. ft. of sand and 21 cu. ft. of broken stone measured, when rammed, 0.96 cu. yd. A total of 10,522 cu. yds. of consrete was used in the foundations, requiring 1,352 bbls. of cement per cu. yd.

Cut Stone.—Cut stone was used for the coping and facing of the lock walls and for the miter walls. This stone all came from Kelly's Island, in the Detroit River, and was a close-grained, tough limestone weighing 157,.23 lbs. per cu. ft. It was shipped in the rough to Sault Ste. Marie and cut to dimensions in the vicinity of the lock. From computations made on several cargoes of stone, it was found that about 26½% of the stone was lost in the cutting. The total number of pieces cut was 14,309, of which there were about 472 different patterns. The average crushing strength of the stone was 12,177 lbs. per sq. in. for practically 3-in. cubes. As far as possible machinery was used for the stone cutting, and work was carried on night and day during the busiest part of the season. The stones were handled by a combination of fixed derricks and McMyler traveling cranes of 10 tons capacity.

The specifications for the cut-stone masonry read as follows:

The stones for the miter walls shall be cut to ⅝-in. joints throughout. The coping stones shall be cut to ⅝-in. joints, except for the bed joints that overlie the backing, which shall not exceed 1 in. in thickness. The stones for the face of the main walls, and the facing of the well holes and passages for the gears for operating the gates and valves shall be cut to ⅝-in. joints on their upper and lower beds, except for such portions of the bed joints as overlie the backing, which shall not exceed 1 in. in thickness; the vertical joints of these stones shall be cut to ⅝ in. for 18 ins. from the face, and the remainder of each of these joints shall not exceed 1 in. in thickness. No joint shall vary in thickness from the dimensions specified, and the dimensions of all stones shall be such that the center of each vertical joint shall not vary more than 1-10 in. on either side of a vertical line through the center of the lowest corresponding joint. Any excess in width of stretchers or length of headers in the face walls will be paid for as "backing stone." All edges on show lines shall be perfect, and no stones will be accepted that are in any way marred or nicked. Show faces shall be cut true and even, without depressions of any kind; but within the draft lines the show faces of stones in courses below the upper 12 courses of the main walls (coping not included) may be rough finished, with no depression below the plane of the face, and no projection greater than 1 in. above the plane of the face. The face stones of the gate recesses, however, shall be finished throughout. All cut stones shall be laid by clamps or by the lewis, and all lewis holes in cut stone kept over winter shall be carefully protected from the weather by the contractor.

As will be noticed, an unusually good quality of masonry was required, and it may be noted that an inspector was stationed with each gang of masons to see that the terms of the specifications were carefully obeyed. The mortar used consisted of 1 part Portland cement and 1 part sand and the pointing was done with a mortar of 2 parts Portland cement and 1 part sand passed through a 40 sieve and thoroughly washed. The amount of cement used per cubic yard of cut stone masonry was 0.292 bbls.

Backing Stone.—The stone for the backing was taken from Drummond's Island, and was a compact, bluish gray, crystalline limestone weighing about 170 lbs. per cu. ft. The specifications required that each stone should have an area of bed of at least 5 sq. ft., and that the average area of bed should be 8 sq. ft. No vertical joints should exceed 4 ins. in thickness, with an average thickness of 2 ins., and no bed joint should exceed 1 in. in thickness. A novel feature of the specifications was that payment was to be made only for the volume actually occupied by the stone in the completed wall. This necessitated a careful record being kept of the amount of mortar used. The amount of cement per cubic yard of backing stone laid was 1.21 bbls. Altogether 58,410 bbls. of cement were used for the backing stone masonry and 4,525 bbls. for the cut-stone masonry. These totals, added to the16,221 odd barrels of cement used in the concrete foundations, make, in round numbers, an aggregate of 79,156 bbls. of cement used in the lock masonry. This excludes the power-house foundations and miscellaneous works.

Altogether 62,935 bbls. of cement were used in laying both face and backing masonry, or an average of 0.778 bbls. per cu. yd. of masonry. Of the total masonry laid 59.2% was backing, 23.1% cut-stone, and 17.2% was mortar. The cost to the United States of the masonry for the whole lock was:

Laying 10,522 cu. yds. concrete, at $4.50 per cu. yd.	$47,349
Furnishing 18,741.04 cu. yds. cut stone, at $26 per cu. yd.	487,267
Laying 18,741.04 cu. yds. cut stone, at $2.50 per cu. yd.	46,853
Furnishing 44,513.25 cu. yds. backing stone, at $6 per cu. yd.	267,079
Laying 48,276.04 cu. yds. backing, at $2.50 per cu. yd.	120,690
Furnishing 7,650 bbls. Portland cement, at $3 per bbl.	22,950
Furnishing 71,755 bbls. natural cement, at $1.30 per bbl.	93,281
Total	$1,085,469

Method of Construction.—The manner of laying the masonry is pretty clearly indicated in Fig. 5. Two 16-ft. gage railway tracks were laid lengthwise of the lock chamber, one just inside each lock wall. On these tracks ran a number of McMyler traveling cranes of 10 tons and 5 tons capacity. Between these two tracks was laid a system of tramcar tracks, passing out of the east end of the lock pit to the docks where the barges from the stone yard unloaded. The loaded cars coming from the barges passed into the lock pit, where the traveling cranes raised the stones to the lock wall in which they were laid. The stones were loaded and unloaded from the yard into the barges, and from the barges onto the tramcars by fixed derricks. All the stones in the lock wall were laid with traveling cranes, except a small portion at the back part of the walls above the 12th course, where they could not reach. Here derricks were used. The construction of these traveling cranes is shown in Fig. 6.

FIG. 3. VIEW OF EXCAVATION FOR LOCK PIT OF 800 FT. LOCK, LOOKING WEST.

Lock Floor and Culverts.—In order to understand the arrangements of the culverts for admitting water to the lock chamber, it will be necessary to

refer to the drawings on the inset sheet. Water is admitted to the lock at the west end, which is the left end of the drawings, by six culverts, each 8 × 8 ft. These culverts are numbered, for convenience in reference, 1, 2, 3, 4, 5 and 6. Culverts 3 and 4 run the entire length of the lock and have openings in their tops the whole length. Culverts 1 and 6 run only one-half the length of the lock, and have openings their whole length. Culverts 2 and 5 run the whole length of the lock, but have openings beginning about the center of the lock and continuing to their ends. To make this clear, the culverts are numbered on the floor plan, which, it must be borne in mind, has its central portion cut out in the drawings in order to get them within the limits of the inset sheet.

To empty the locks, there are also six culverts. The location and dimensions of these, as well as of the filling culverts, are shown by the drawings.

clearly shown in the drawings. On the top of these walls were laid 12 × 12-in. transverse timbers 6 ins. apart. These timbers are bolted, as shown, to the foundation rock through the bottom transverse timbers. The lock flooring is laid on the transverse timbers, and consists of two layers of 3-in. plank spiked with 8-in. spikes. The apertures for the admission of water are cut through these planks, and are 2 × 4½ ft., but the transverse timbers are not cut through, so that each aperture is divided by the transverse timbers into three 2-ft. × 6-in. openings.

The method of conducting the work calls for little of especial mention, except where in one or two cases especially designed tools were devised to accomplish certain operations which occurred very frequently. Perhaps the most interesting of these tools was the apparatus used for drilling the bolt holes. Many of these holes

With this apparatus the drilling, which had been given up by one contractor at 25 cts. a hole, was done at a cost of less than 5 cts. a hole, much to the profit of the ingenious contractor who devised it.

In the next article on this work the construction of the valves and gates will be fully illustrated and described. These gates are the largest steel lock gates in the world. For the information from which this article has been prepared we are indebted to the engineers in charge of the work. These are Col. O. M. Poe. U. S. Engineer Corps, the engineer in charge of the work of securing a 20-ft. channel on the Great Lakes; Mr. E. S. Wheeler, Assistant Engineer, in charge of the improvement of the St. Mary's River; Mr. J. L. Callard, engineer in charge of the lock construction, and Mr. L. C. Sabin, Assoc. M. Am. Soc. C. E., engineer in charge of cement tests.

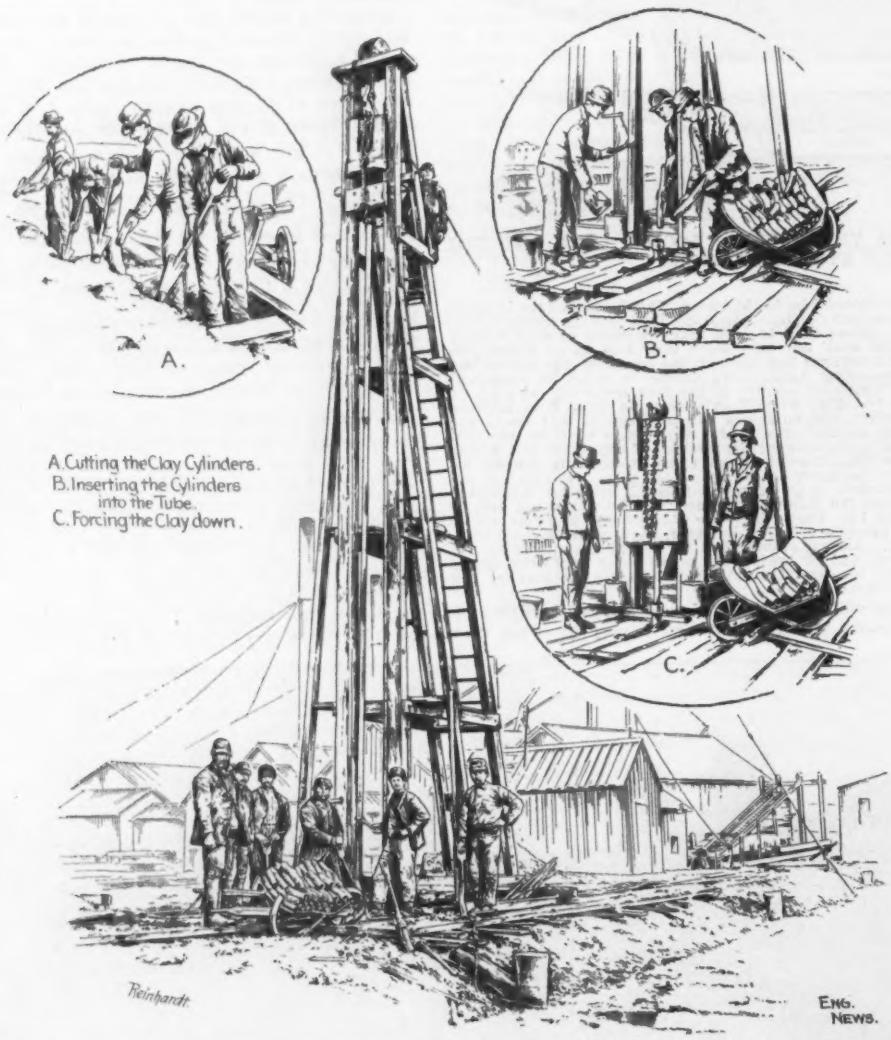

FIG. 4. APPARATUS USED TO FORCE CLAY INTO CREVICE OF FOUNDATION ROCK AND CLOSE LEAK IN COFFERDAM.

These culverts are closed by 12 iron and steel valves, which will be described in another article.

In constructing these culverts the bottom of the lock pit was first thoroughly cleared of broken stone and washed clean of all chips and dirt. A thin coating of mortar was then spread on the rock, and on the top of this was laid the concrete. Longitudinal timbers, 12 × 12 ins., were first laid about 10 ft. apart and bolted to the foundation rock with 1½-in. bolts spaced 3 ft. apart and extending at least 3 ft. into the rock. Each of these bolts was tested by a pull of 10 tons. On the top of these longitudinals, traverse timbers, 12 × 12 ins., were laid 6 ins. apart, and drift bolted to the longitudinals and also bolted to the rock. These transverse timbers were covered with a flooring of two courses of 3-in. plank, after all interstices had been filled with concrete. The sides of the culverts were made by bolting 12 × 12-in. timbers, one on top of the other, as is

penetrated the partially green concrete to 6 ft. and over in depth, and, as every engineer will understand, the drilling of such material is extremely difficult, owing to the wedging of the drill. The apparatus used by the contractors for this work is shown in Fig. 7, which is drawn from a rough sketch made on the ground, and only approximately to scale. As will be seen, the drill is hung on a small pile-driver frame occupying exactly the position the hammer would occupy in a pile driver, and is raised and lowered by a hand windlass. By this arrangement a longer drill can be used than with the ordinary tripod arrangement, and less changing of drills is necessary. The very simple thing which enabled the soft concrete to be drilled without wedging, however, was the small metal pipe which was carried into the hole with the drill, and through which water was forced under heavy pressure. The force of the water carried off the chips so rapidly that no wedging was possible.

STREET RAILWAY TRACK CONSTRUCTION.*

By C. Loomis Allen.

It has been only recently, and after very costly experience, that much attention has been given by street railway officials to the matter of foundations, or to the conditions of the subgrade, but I am sure that experience will bear me out in the statement that economy in track maintenance begins with the making of firm foundations. A great many obstacles are encountered in finding firm foundations for electric roads, which the steam roads do not have to encounter. The first work is the excavation of the material in the street to subgrade. The sewers, water mains, gas mains, electric conduits or subways having usually been previously constructed a sufficient length of time to allow the trenches to settle (the popular idea is that one winter will settle trenches), the surface of the street seems firm, and fairly solid; excavation progresses to such depth as is desired, and the rolling of the sub-grade with a heavy roller is begun. Then appears the condition of improperly-filled trenches, vexing the engineer in charge, and making him thoroughly disgusted with the manner in which the construction of underground structures is conducted, for with sewers in the center of the street, gas and water pipes and subways on either side, very little undisturbed ground can be found.

Backfilling of trenches is usually provided for by a special clause in the specifications for underground structure, and this clause is supposed to cover the treatment of all classes of soil, but in actual practice each type of soil requires a different treatment. I do not propose to discuss the manner or methods of trench filling, but I do suggest that railway companies cooperate with city officials in placing in specifications for underground structures clauses pertaining to the proper filling of trenches, and in seeing that the conditions of such clauses are fully carried out. The question of backfilling has not been given the amount of attention that should have been given it by engineers.**

Some few railway companies have become so thoroughly discouraged in attempts to obtain firm foundations, that they have gone to the great expense of placing concrete foundations 6 ins. thick under the ties to support them, thus bridging the various settlements, but, except in extreme cases, the cost makes this method out of the question. I maintain that trenches can be properly filled, and that by sufficient rolling, a firm subgrade can be obtained, permitting the use of broken stone ballast. All soft and spongy places in the subgrade should be removed, and tile drains laid and connected to sewers. The subgrade should then be rolled to conform in line and section with the finished grade. Upon the subgrade should be spread the ballast, and no better quality of ballast can be obtained than 2-in. broken stone. There should not be less than 8 ins. of broken stone ballast under the ties after the track has been surfaced and tamped. The broken stone should be evenly spread in the trench to such a depth that, after having been thoroughly rolled, it will be not less than 6 ins. thick. The rolling should be done by a steam roller weighing not less than ten tons, and should be continued until the mass of stones becomes thoroughly compact. Upon the broken stone are placed the ties.

The use of metal in ties is bound to come, but as long as Southern ties of long-leaf yellow pine, of standard size, can be delivered on the cars or wharves of any of our large cities for 50 cts. each, the day for the use of steel ties is deferred. I believe thoroughly in the use of metal ties, and that they are the most economical remains only to be proved by the experience gained from their use, but the use of wooden ties is bound to be common at the present prices for first-class ties, and at these prices no one need buy poor or cheap ties. In drawing specifications for ties, do not place clauses

*Abstract of a paper read at the annual meeting of the New York State Street Railway Association, held at Albany, N. Y., Sept. 17.

** See Engineering News, Sept. 5, 1895.

in them which experience has taught that it is impossible to fulfill. Specify the kind or quality you know can be bought in the market, and make the size not smaller than the standard size—8 ft. long, 6 ins. deep, and 8 ins. wide. Then see that the ties are such as the specifications call for. Do not place less than 120 lin. ins. of tie bearing to a rail length of 30 ft.

The rails to be used in streets of cities should weigh not less than 85 lbs. per yd. for a section 7 ins. deep, and if the section is 9 ins. in depth, it should weigh not less than 95 lbs. per yd. Select a section with a base not less than 5¾ ins. wide, and have the width of the head not less than 2⅛ ins. Some maintain that the girder rail with the side-bearing head is the better, and is more easily kept open to traffic than the half-grooved girder sections. I can speak from experience that the half-grooved girder sections we have received from the Johnson Co. are better finished, and make smoother riding track, but we have not yet had the opportunity to try them during a winter, to see if we can successfully maintain traffic. The city of Buffalo, however, is an example of successful operation of such rails for many winters.

The splices or channel bars should be at least 32 ins. in length, and if for the 9-in. rail, should be punched for twelve 1-in. bolts. The corrugated plate manufactured by the Johnson Co. is the best type yet presented, but with any bar 32 ins. long bolted tight with 1-in. bolts, and the nuts held in place by nut locks, the joints should not give way sooner than the rail itself. In fact, the question of joints with splices of this kind, properly bolted, is transferred to a question of ties and their supports.

Combination brace-plates are preferable to tie-rods, and there are several types of combination plates manufactured. The Johnson Co. makes a single-brace plate and tongue, and the Mark Railway Equipment Co. has a double brace-plate. If tie-rods are used the chances are that the spiking gangs do not try the gage of the track more often than on every other tie, and some of the time they forget to do that, trusting to the tie-rods to spread or pull the track to proper gage. Where the brace-plates are used, the spikers must use the gage-rod at every tie in order to maintain the gage of the track, and in consequence, you have a track laid with greater care, so far as gaging and spiking are concerned, than you will have with tie-rods. Tie-rods in a pavement tend to constantly help, by vibration, the disintegration of the pavement, to say nothing of the trouble encountered in paving around them.

In laying tracks in city streets, lay the rails with broken joints, and no matter what the temperature may be, be sure the joints are laid without open spaces between the rail lengths. Put the ends of the rails up tight, and when they are in that position, bolt the plates up, driving them home with a hammer. Do not spare the cost of inspection at this point, but be sure that the joints are all tight. With properly-bolted plates and rail ends tight, you have approached as near continuous track as it is possible without welding the joints, and yet you have given a chance for contraction in extreme winter weather.

In driving the spikes, be sure that the gage-bars are tried on every tie. Use spikes 5½ × 9-16 ins., four on every tie. When the rails are thoroughly spiked and bolted, the track is ready for surfacing and tamping. The ballast is already 6 ins. thick, leaving 2 ins. for this final work, and great care should be taken to properly tamp each tie firm. Ties tamped with broken stone ballast do not sound as firm as ties tamped with gravel ballast, but broken stones will stay in place, while gravel ballast will wash down. Tamping with broken stone costs more, but firmer track is the result. The track is now ready to receive its final alinement, and all irregularities in line should be taken out with great care. Unless block stone pavement is to be laid, fill to the top of the ties with broken stone, made thoroughly compact by the use of rammers. Once more try the bolts and splice bars, to see that all are tight, and then place the nut locks to keep the bolts tight. The track is now ready for bonding, and the type of bonds that will give the greatest contact with the rail should be used, connected by a single No. 0000 wire. The use of single bonds of a larger size saves labor when compared with the use of double bonding with bonds of a smaller size. The track is now ready for the paving.

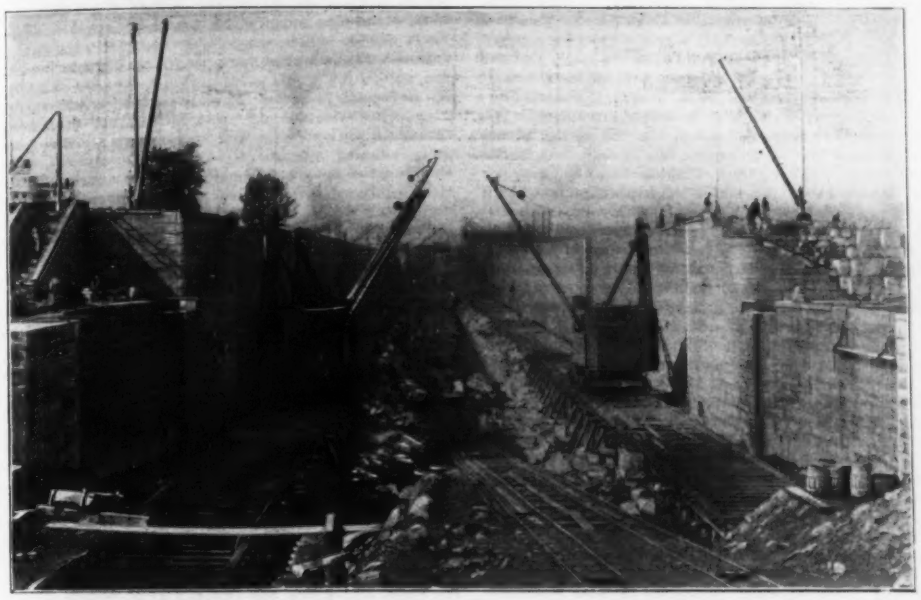

FIG. 5. VIEW OF LOCK LOOKING WEST SHOWING MANNER OF LAYING THE MASONRY.

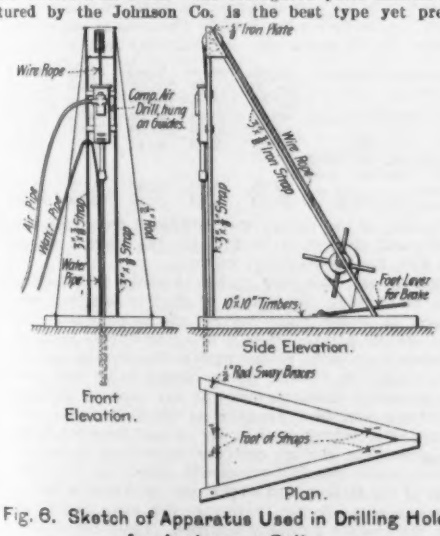

Fig. 6. Sketch of Apparatus Used in Drilling Holes for Anchorage Bolts.

TESTING THE FRAMES OF WAR-SHIPS.

An important test of 14-in. steel armor plate, and also of the strength of the frames of modern war-ships, took place at Indian Head on Sept. 4. This is practically the first test that has anywhere been made of the strength of the frames of modern war vessels to resist the impact of projectiles. The target was an exact reproduction of a side section of the battleship "Iowa," and the plate tested represented 620 tons of armor made by the Carnegie Steel Co. for this ship. It was the first official test of the new double-forging process, the plate being forged both before and after the Harveyizing treatment.

The plate was 14 ins. thick, 18 ft. long by 7½ ft. high, and was part of the "belt armor," extending 5 ft. below and 2½ ft. above the water line. Behind this plate was 5 ins. of oak; then came the "skin" of the vessel, made of two steel plates, each ⅝ in. thick. Four feet back of this was the ⅝-in. steel inner shell, and between this shell and the skin were the frames, made of ⅝-in. steel plate, spaced alternately 2 ft. and 4 ft. apart. The top of the structure was covered by a 2½-in. steel plate, representing the protective deck. This target was supported by heavy timbers abutting against the side of a hill; and while some may object that this did not fairly represent a target afloat, the naval officers calculated that the difference would be very slight, because the vessel in the water could not yield quickly enough to be of any benefit to the target.

The first shot was from a 10-in. gun, with a 500-lb. Carpenter projectile and 140 lbs. of brown prismatic powder, imparting a velocity of 1,472 ft. per second, and a striking force of 741,000 ft.-lbs. This shell was completely shattered on impact, leaving the point imbedded, but so loosely that it dropped out on the jar of the third shot. The backing and frames were uninjured. The second 10-in. shell had behind it 216 lbs. of powder, giving a velocity of 1,862 ft. per second. As before, the shell was shattered with a larger portion imbedded in the plate. There was still no crack or bulge in the plate, and no injury to the frames. One of the armor bolts was struck and driven out, and the thread was sheared off, as was expected with the makeshift bolts used.

On these two shots the armor passed the inspection, but a further trial was made with a 12-in. Wheeler-Sterling projectile, weighing 850 lbs., the usual test for 17-in. armor. The powder charge was 400 lbs., imparting a velocity of 1,800 ft. per second. It was expected that this shell would pass clear through the target; but while the plate was penetrated almost its whole depth, and cracked from top to bottom, the oak backing was scarcely disturbed, and the outer skin and frames were not disturbed at all. Another armor-bolt was forced out, and the bolts in the protective deck were sheared off, but all the tests were universally satisfactory.

On Sept. 17 a second and final test was made of both plate and backing, by using against it a 13-in. shell, weighing 1,100 lbs., and having a velocity of 1,800 ft. per second imparted to it by a charge of 480 lbs. of brown powder. This was the cracking test for 17-in. armor, and was sufficient to pierce armor of that thickness. The shell passed through the plate and the backing and frame. The plate only showed two cracks in addition to the hole made by the shell, and thus exceeded expectations. Three divisions of the framework, through which the shell passed, were destroyed and partly carried away, but the remainder of the frame was intact without a rivet started.

The result of this novel and most severe test was eminently satisfactory to the Bureau of Naval Construction. It is demonstrated that the frame is as strong as the armor, and as one important outcome, it is said that ½-in. steel plates will be used in the new battleships instead of ⅝-in. plates; the thinner plates being deemed strong enough for the service required of them. Among the minor points settled was the efficiency of a new and shorter bolt for securing the armor, which will be cheaper than the long bolt now in use.

MOVING TWO 36-IN. WATER MAINS WITHOUT SHUTTING OFF THE WATER.*

By E. C. Moore, Jun. Am. Soc. C. E.

During the construction of the Lexington Ave. cable railway in New York city it became necessary for the engineers of the Metropolitan St. Ry. Co. to move two 36-in. cast iron water mains without shutting off the water. These mains were laid in 1889, and were in 9-ft. lengths. They had to be dropped for about 2 ft. and moved sideways about 1 ft. for a distance of 100 ft., and for the same distance on either end of this section there was some shifting of position, so that the change in direction in passing from the old to the new location might be as gradual as possible.

The first work was to erect a yoke over each joint, from which the pipes could be hung by a chain and turnbuckles. The yokes were of 8 × 12-in. yellow

*Abstract (from the Society's bulletin) of a paper to be read before the American Society of Civil Engineers at the meeting on Oct. 2.

pine, the posts being 8½ ft. long, set on a wooden foot block of 5 × 12-in. yellow pine 2 ft. long, and the cap piece was about 11 ft. long, being 9 ft. between the posts. The cap was laid on top of the posts without framing, and fastened to them by 2 × 9-in. spruce cleats about 2 ft. long, one being nailed at each post and on opposite sides of the bent. Then a diagonal brace of 2 × 9-in. spruce about 3 ft. long was nailed diagonally from the cap to each post on the opposite side to the cleat.

As soon as the first bent was set up and braced from the ground, the next bent was set up, and the two were fastened together by nailing two pieces of 2 × 9-in. spruce on top, reaching from one bent to the other at the ends, and so on until 20 bents were in place. Then the chains, which were of ⅞-in. round iron, with links 7 ins. long on the inside, were put in place. The part of the chain which went over the yoke was 5 ft. long, and the part which went under the pipe was 11 ft. long. There were two turnbuckles at each bent, so that the chain would not have to slip around the pipe or cap in lowering. Each turnbuckle was of 1½-in. iron, with hooks on each end, and could lower 12 ins. without changing hooks, which were made to just fit in the links of the chain. When the pipe was dropped as far as the turnbuckle would go, the latter was taken off in its turn and the hooks placed in links nearer the end of the chain, when the lowering proceeded as before. Everything was made of sufficient strength to allow of every other turnbuckle being taken entirely off without blocking the pipe.

The lateral movement of the pipes was accomplished by hanging the chains over the cap piece, a few inches to one side of a perpendicular through the center of the pipe, and putting a 4 × 6-in. spruce brace from the end of the cap to the bank, to prevent the bent from moving toward the pipe, instead of the pipe toward the bent. At the same time a 2 × 9-in. spruce brace was added at each end of each bent, running diagonally from the top of one to the bottom of the next, and in opposite directions at the opposite ends of the bents. This was done to take care of the torsional strain caused by the cap being at right angles to the pipe.

By beginning at one end, it was possible to lower the first 100 ft. of the pipe into position, and to take down and move ahead the first 11 bents; then, as the pipe came into position, each bent was taken down and moved ahead again. The two pipes lay parallel to each other, and 5 ft. apart, c. to c. One pipe was lowered at a time. There was one hydrant connection in each pipe, which had to be cut in moving. Occasional small leaks occurred while the pipes were being lowered, but they generally stopped as the pipe was lowered, and the joint had a chance to come back into place. When the pipes were in place, all the joints were gone over and put in good condition. The work was carried on day and night, and cost $5,501.71.

ELECTRIC POWER PUMPS FOR WATER-WORKS.*

By John M. Goodell, Assoc. Am. Soc. C. E.

Until within a comparatively few years engineers engaged in designing systems of water-works, where pumping was necessary, were restricted to steam and hydraulic power to operate the requisite machinery. It is hardly necessary to say that such a restriction has proved extremely burdensome in many places. Good water powers are rarely to be found at sources of a good public water supply, and the latter can seldom be secured in such localities that the cost of hauling coal to them is not a considerable expense. The consequent desirability of economy in fuel consumption has led to the construction of several types of steam pumps which are certainly admirable pieces of mechanism. But even the steam pump in its best forms does not answer all requirements, especially for small plants. Where the volume of water to be pumped daily is small, the amount of coal burned is comparatively large for the work done, and the stations are usually built so far from the railways that by the time the coal is dumped in the shed, it has proved pretty expensive. Consequently there has long been a feeling that a new method of pumping was desirable.

The Germans were probably the first to break away from the steam pump, which they replaced with a power pump, driven by a gas engine. Duren was the first place to adopt such a combination, which was done in 1884, but the example was quickly followed by other cities, and there are to-day about 15 water-works pumping stations in Germany driven by gas, gasoline, or oil engines, in an apparently successful manner. The reason for the adoption of the gas engine was simply its economy. There is hardly a German town of any size without its gas-works, which are frequently owned by the city and operated under the direction of the same engineer who superintends the water-works. The pumping stations are generally some distance from the railways, and in a number of places it was found, on careful investigation, to be cheaper to lay a gas main to the stations and put in gas engines than to erect a steam-pumping plant. Germany is a country where the gas engine has been brought to a condition of remarkable efficiency, owing to the widespread availability of gas, and it is, therefore, natural that this motor should be selected to replace the steam engine. In several recent plants, gasoline, oil, and producer gas engines have been installed to operate pumping stations, the choice in each case being due to the fact that the total cost of operating the plants with them, including interest and depreciation charges, was estimated to be less than with steam.

A great deal is to be learned from these German water-works, which have been described in a number of foreign papers. Pretty full translations of these articles have begun to appear in the "Engineering Record," so it is hardly necessary to refer to them here at length. The earlier German power-pumping plants were largely experimental, and, in their operation, a number of features capable of improvement were found. The least satisfactory point about them was the use of a comparatively long train of gearing between the pump and the engine. This transmitted power well enough, but it made altogether too much noise. It was necessary, however, on account of the little knowledge then had of the capabilities of the power pump. In the earlier plants these pumps had to be run at low speeds, but in the later works, triplex pumps, making 60 to 80 revs. per min. (about twice the speed of triplex pumps, with 10 × 12-in. cylinders, in this country) have proved noiseless and free from shocks. It was, therefore, unnecessary to retain the gearing, as the reduction in speed between the gas engines, making about 150 revs. per min., and the pump shaft, making 60 to 80 revs., was accomplished by selecting pulleys of suitable diameter, which were connected by leather or rope belting. The most suggestive fact to be learned from these plants, however, by an American engineer is the value of careful atention in the design of the suction and air chambers of the pumps, details which are too frequently considered of minor importance, even on steam pumps. Mr. Max Munzel, engineer of the Otto Gas Engine Works of Deutz, atributes the success of many of the plants under consideration, especially the satisfactory running of the pumps at the speeds mentioned, to the proportioning of these chambers to the special conditions of each locality.

In this country we do not have a gas plant in every little village, but, on the other hand, there are few American towns with any enterprise in them which do not have an electric lighting plant, or do not want one. It is hardly necessary to call the attention of the members of this association to the large number of combined water and electric light plants which are now proposed, or in course of construction, and the object of this paper is merely to point out a method of designing the water-works part of such a plant, which is somewhat novel, and opens a field for economical construction and management well worth studying. Possibly the best way of showing the capabilities of this method is to describe one of the few American plants already constructed, in which it was adopted. The plant of the Monroe Water-Works & Light Co., at Monroe, La., offers a good example, and its construction reflects much credit on the good business judgment of Mr. W. E. Hawks, of Bennington, Vt., a member of this association, and president of the company. It was the original intention of the company to supply artesian well water. Three wells were sunk, and all arrangements made for using them as a source of supply, but the consumers wanted river water, and it was, therefore, decided to give it to them. The electric light and artesian well station is about a mile from the river, and is amply large enough to furnish the small amount of power necessary to pump all the water needed. To construct an independent pumping station on the river bank, as would have been absolutely necessary but a few years ago, was undesirable for many reasons, so it was decided to build a small power-pumping station, operated by electricity from the main station. Moreover, as the river has a rise and fall of some 48 ft., it was necessary to adopt a special design for the entire pumping plant.

Two plans were possible by which the pumps could be operated. The first was to build a deep pump well, and the second was to build the whole station on a car, which could be hauled up and down an inclined track, like a small ship railway. The second plan was adopted, and the use of an electric motor and triplex pump made the construction much easier than had a heavier and larger steam-pumping plant been necessary. The railway is nearly 500 ft. long, and was built on piles. The pumps are mounted on a car 28 ft. long, 12 ft. of which is occupied by the house sheltering the machinery, the rest of the car being used to support the suction pipe, which projects out from it into the water. The pump is of the triplex pattern, furnished by the Goulds Manufacturing Co., of Seneca Falls, N. Y., and has a capacity of 400 gallons a minute. It is connected by spur gears with a slow-speed 15-HP. Westinghouse motor. The car is hauled up the track by means of a wire cable and a hand winch at the head of the incline, and is clamped to the track at four places, while the pumps are running. The current is supplied through No. 0 three-braid wire. The discharge pipe is fastened to the ties at one side of the track, and is provided with 20 flanged and capped heads along its length, any of which may be connected with the pump. The current for the motor is supplied by the same 50-HP., 500-volt Westinghouse generator at the main station that furnishes power for transmission throughout the town. This works is a small one, to be sure, but it illustrates very well the advantages which electricity offers. It is self-evident that a steam plant could hardly be built and operated so satisfactorily as the one which was constructed.

One of the earliest electric-pumping plants in this country was built at San Antonio, Tex., for the local water company, to supplement two plants operated by water power, and located some three miles from the business center of the city. The electric plant was placed in the heart of the city, within a few feet of a 45-ft. stand-pipe supplied by four 8-in. artesian wells. Three Goulds triplex pumps were installed, each having three outside-packed plungers of 10 ins. diameter and 12 ins. stroke, the whole plant having a capacity of 2,250,000 gallons in 24 hours. Each pump was provided with a separate suction pipe and valve, and discharged through a separate pipe and check valve into the force main running to the city distributing system, thus enabling the amount of pumpage to be adjusted fairly close to the demand. Each pump was connected directly to a 30-HP. C. & C. motor, taking a current of 500 volts from the lines of the local electric light company.

Several features of this plant deserve attention, as indicating some of the advantages of such works. It will be noticed that the old pumping plants were operated largely by hydraulic power, some three miles from the city, while the new plant is located in the town. This means the elimination of a friction head of 20 ft. at least, and probably much more. Another thing to be noted is that there was no boiler plant at the new station. Whenever the pressure fell in the water pipes, it was only necessary to turn one, two or three switches to throw as many electric pumps into service, and by opening the switches again, the pumps were stopped. The electricity was not running to waste while the pumps were idle, and there was no banking of fires under boilers. All this means that not so much attendance was required.

One of the latest plants of this sort is that at De Kalb, Ill., which has two 10 × 12-in. Goulds triplex pumps, driven by two direct-connected General Electric motors.* This plant was recently tested by Mr. Daniel W. Mead, and some figures from his report are appended, as indicating the general efficiency of the station, although it should be stated that the apparatus was new, and consequently stiff, and that the electromotive force was not kept up during the tests, facts which naturally tend to lower the records materially. A test of one of the motors, which was furnished with a current of 200 to 220 volts, showed that its efficiency ranged from 83%, while delivering 20 HP. to the pump, to 92%, while delivering 55 HP. The tests of one of the pumps and its motor gave the following results:

Duration, mins....	14.00	28.00	12.00	44.00	60.00
Amperes	156.00	215.70	206.05	243.30	111.00
Volts.	193.40	192.00	195.00	186.80	203.00
HP. furnished.....	40.44	55.54	55.54	60.93	30.20
Total lift.....	88.50	130.00	129.50	133.50	62.00
Revs. per min.....	41.75	42.50	41.71	45.90	44.80
Combined efficiency of motor and pump	64.90	71.00	72.00	71.90	65.60
Pump efficiency ..	70.50	75.40	78.10	75.20	75.20

The slip of the pumps was calculated from indicator cards, and seemed to be 12% for the suction valves and 0.9% for the discharge valves.

This station, like that at San Antonio, is instanced here as showing the utility of electric pumping machinery in places where current can be obtained from local electric plants. Such a pumping station occupies comparatively little room, requires the services of but one engineer on a shift, has no boilers to be fired, and can be put in instant service at any time, by turning the proper switches. Its greatest drawback is the possibility of a sudden stop in the current supplied from the generating station, and the importance to be attached to this possibility depends largely on the character of the station and of the men in charge of it.

Such works are not, however, the most promising field for electric pumping systems. Their advantages are most apparent when it is necessary to build works for a small place without water in the immediate vicinity. In such a locality, the pumping station may be required several miles from the town and from a railway. If it were a steam plant, the annual cost of fuel delivered over rough roads to the station may be a serious matter. In such a place, electricity offers an easy solution of the problem. As an example of what it will do, the plant at Canandaigua, N. Y., may be cited. This is still in course of construction, and it is, therefore, hardly proper to more than outline its

*A paper read at the Atlanta meeting of the American Water-Works Association. Publication has been postponed till the present date at the request of the author.

*An illustrated description of this plant, written by the engineer, is presented elsewhere in this issue.

features here. The power station is conveniently located in the village, while the pump house is at Canandaigua Lake, 3½ miles distant. Two of Goulds 12 × 12-in. triplex pumps are driven by a direct-connected, 100-HP. General Electric motor. The three-phase system of transmission is to be used, and the current is to be furnished by a 100-K-W. generator at the power station in the town. This generator is to be driven by an engine of 115 HP., nominal.

It is for such a plant as this that electricity seems particularly suited. The advantage of putting the power house near a railway, so that coal can be secured at a low rate, is an important matter, and if an electric light plant is to be installed at the same time as the water-works, the use of power pumps is all the more likely to be profitable. The demand for water varies inversely through the 24 hours to that for artificial light, and this makes the design and economical management of such a combined plant so much the easier. The writer does not mean to say that such a station will be suited to the local conditions of every town wanting water and electric light, but he does believe that a town will make a mistake in adopting independent plants for such purposes, without securing estimates of the cost of building and running a combined station.

Another promising field for electric pumping is furnished by small high-service districts which have to be supplied by special pumping apparatus of small capacity. Still another use to which they may be put in some cities, covering a large flat area, and supplied with water from one or two main sources, is to serve as "relay pumps," similar to the relays used on oil pipe lines. These are located at a considerable distance from the main pumps, at places where the friction head in the pipes has reduced the pressure materially, and raise this pressure by taking water from the main pipes, and forcing it along through them under a greater head. In this way the pressure on the pipes before and behind the relay station is increased.

ECONOMICAL EQUIPMENT AND OPERATION OF A POWER-HOUSE.*

By H. S. Newton.

The Syracuse Street Railway Co.'s plant is made up of three double compound engines of the upright, marine type, having cylinders 16½ and 31 ins. diameter, and 24 ins. stroke. These are belted direct to multipolar generators of 300 KW. capacity, and each exhausts into an independent surface condenser. The condensed steam from the condensers is pumped through an oil filter, or separator, into a hot well, from which the boiler feed pumps convey it through a pipe heater to the boilers. By this arrangement not more than 10% of the boiler feed water is taken from the outside water supply, and all difficulty with scale is practically overcome. The boiler house contains five 90-in. return tubular boilers, 16 ft. long, each having 118 tubes, 4 ins. diameter. These are fed by a pair of pumps, one acting as a relay to the other. The whole plant has been in operation only a few months, and it has been impossible as yet for us to make an accurate test as to its economy. Our coal and water bills have demonstrated the fact, however, that we are making power at a low rate, and we are having an entire absence of trouble with the plant. The feed water is introduced into the boilers through a line of 2½-in. piping, connected to duplicate pumps through a pipe heater. We have found two objections to hold against the arrangement as adopted, the correcting of which will influence somewhat the economy of the station. The first of these is the fact that in covering the live steam pipes it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five or ten degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss. The second point is the absence (since remedied) from the feed-water pipe of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance, if not absolutely unnecessary, but we have found it of decided advantage in prolonging the life of the valves, and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system. In this connection I wish to call attention to the importance of an injector for each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which my experience goes to show has a decided tendency to get out of order.

Concerning the economy of using over and over again for boiler feed the condensed steam from the engine exhausts, a great deal may be said. The surface condenser, the necessary adjunct to this practice, is not a particularly rare piece of apparatus, but I find that a surface condenser which is called upon to perform this as one of its functions is decidedly uncommon in street railway practice. In numerous stations it is used to obtain a vacuum, but in very few is the water of condensation utilized. The character of the water around Syracuse made it very desirable that we should utilize the condensed steam if possible, and after what promised to be some very disastrous experience, we have at last succeeded and are running very successfully, as mentioned before, with over 90% of our feed from this source. The immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark brown sediment which caked over the bottom seams. We removed this, and tried it again, concluding that it might be shop grease and dirt. Again we had the same result. Examination of the old filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting, resulting in a leaky boiler or two, and the consumption of a vast amount of chemicals, we have located and remedied the trouble to our entire satisfaction.

The accumulation noticed seems to have been the result of three causes: 1, The use of too much cylinder oil; 2, the use of the wrong kind of cylinder oil; 3, insufficient filtration of the oil from the feed water before going to the boiler. The first of these causes was of course, soon remedied, and the old-fashioned notions of our engineers were shocked with the order to use only three drops a minute for each engine. The second cause we were longer in discovering the remedy for. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate, and lastly, kerosene oil. None of these expedients proved effective, however, and it was not until we changed our cylinder oil that we solved the problem. We purchased some oil of purely mineral stock, which has worked so well as to lead me to conclude that it must have been the animal fat in the other oil which was doing the mischief. We are using this oil to-day with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pail full of soda-ash pumped in with the feed water before cooling off. The third cause of trouble we have recently largely overcome by introducing a number of partitions in our oil filter, by means of which the water is caused to flow alternately over the top of one and under the next, in this way allowing the oil to settle from its emulsion, and be collected in the excelsior filling.

The factor that after all has seemed to be strongest in the solution of our problem in economy is the choice of fuel. We have done quite a good deal of experimenting in this line with various grades of coal, and the results obtained have been such as to lead me to very strong conclusions. The best coal, and by that I mean the cheapest fuel, we have found to be anthracite buckwheat, costing on board cars at our station $2.25 per gross ton. The dust anthracite I find will sift through the bars. When mixed with an equal amount of soft coal, it works very well, but necessitates the help of an extra man as a mixer, and is not so economically fired. We are using 13 tons of buckwheat a day, where it was necessary to use 17 or 18 tons of the mixture.

Our experience with special devices, such as high and low water alarms, automatic damper regulations, etc., in the boiler house has been most satisfactory. We have found that the less responsibility you place on the man who shovels in your coal, the better off you are in the end. By making the engineer responsible for the operation of the devices, and keeping them in repair, you are insuring yourself, beside obtaining a great deal better boiler house economies than you could otherwise expect.

The vertical marine type of engine has given us thus far very good service. The most serious objection that we can urge to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, we have found it necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head and crank bearings, and more noise. With more compression we get hot cross-heads and guides, and we consider that we have chosen the lesser of two evils. Our engines are provided with piston valves for the high-pressure, and gridiron slide valves for the low-pressure cylinders.

The engines will govern to within 3%, or about as well as the Corliss type of engine. I do not think the true importance of good engine government is recognized by street railway men. One is apt to regard a badly governing engine merely as an inconvenience resulting in slower speed on the cars and dim lights. The additional loss of power on the line, viz., in the feed wires, trolley wires and rail return, resulting from the decreased voltage at the station, is often entirely lost sight of, and a few figures on this point may be interesting.

Given a station with generators compounded for a constant potential of 500 volts, with constant speed on the engines, and a system of feeders allowing for an average loss on the line of 10%, with full load on the machines. With our engines governing perfectly, 10% is lost in transmission. If they slow down as the load comes on, so that the dynamos show only 450 volts with the same watt output, over 12% of the total energy will be lost in transmission, and with 400 volts on the machines, over 15% will be lost. Therefore, when we couple with these facts the consideration of loss of light and decreased efficiency of motors at the low voltage, it is plain that too much importance cannot be given to the government of prime movers.

In conclusion, I cannot refrain from adding one more voice to the cry against cheap labor in the power house. What help of that kind we do employ, and we are not extravagant, is used in a subordinate capacity. Our present engineer in charge was employed by me after a very clear demonstration that a cheap man was not capable of handling the plant. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation, and the man with brains commands good wages. The pressure which is brought to bear on the management for reduction of wages in the power-house is often severe, as I can testify, but the moment the concession is made, the trouble begins, and a shutting down for repairs on your road becomes a common occurrence.

Discussion.

Mr. Ostrom (of Philadelphia).—I would ask if the vertical type of engine gives the same facility for examination by the manager. Mr. Newton has a good engineer, a man of brains, as he says, which many companies lack. I have heard in my travels quite severe strictures made on the vertical type of engine, on the ground that the engineer will not go up and down stairs to oil it, and the manager, in passing through the room, has more difficulty in seeing if the work is being done properly than he would with the horizontal engine.

Mr. Newton.—If you have a lazy engineer, the objection holds most decidedly; but with the class of men we are employing at present, we have had no trouble at all. For several years it has been my practice in my visits to the power-house to go up on the deck of the engines (the decks of the three engines are all connected), and walk through, and pay some attention to the lubricator; and I generally use my ears as well. At first we had a cheap man to begin with, and we had some very serious trouble at the outset, but since the present man has been in charge we have had very little to complain of; and as far as the facilities are concerned for the manager to go over the plant, it also requires a manager who is not lazy.

Mr. McNamara (of Albany).—How many cars are they able to move in Syracuse with 13 tons of coal, and what is the pay of the engineer and fireman?

Mr. Newton.—We have one line which has some very severe grades, including one of 8%, with a curve thrown in. We are running about 38 cars on that amount of fuel. The chief engineer gets $100 a month, and we work two shifts of 12 hours each. Coal costs $2.25 per ton.

Mr. Barnard (of New York).—Does not the use of the surface condenser lead to foaming in the boilers, and how much does the use of the condenser save in the water tax?

Mr. Newton.—We do not have any foaming; we had some at first, but that has disappeared. As to the water tax, we do not use city water; we use it from the Erie Canal, which flows past the station. It is seriously impregnated with salts, and it is more on account of that than anything else that we adopted the surface condenser. You understand that the exhaust from the engines runs though this surface condenser, and it is condensed into water; that water is pumped through a filter (an auxiliary filter, with these compartments in it that I speak of) direct into the boilers through a pipe heater, and we obtain from the hot well very warm water in the first place, and we really require very little heating capacity in the heater.

Mr. Barnard.—Does the injector handle the feed water at its temperature in the hot well without trouble?

Mr. Newton.—That is one of the points in which our station is lacking; we have no injector. My former practice, however, would lead me to think it would feed it all right from the hot well, without any of it going through the heater. We are operating at 116 lbs. pressure, and the boilers are built for 120 lbs. pressure. We started out with the expectation of using 100 or 110 lbs., and when the demands of the load made it necessary, to increase our pressure to 125 lbs.

*Abstract of a paper read at the annual meeting of the New York State Street Railway Association, held at Albany, N. Y., Sept. 17.

The practical completion of the Tequixquiac tunnel, as announced in the annual message of President Diaz, at last makes the drainage of the valley of Mexico a possibility. While Mr. Francisco de Garay, in his original plan, contemplated the entire drainage of Lake Texcoco, and the reclamation of great tracts of fertile lands, motives of economy raised the level of the open canal and tunnel, and will still leave the lake, although with a much diminished area. The canal is 29½ miles long, and the tunnel is about 6¼ miles, and the total cost so far has been about $13,000,000. The drainage water, will empty into the Gulf of Mexico, at Tampico, by way of the Pamico River.

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The unfortunate lack of data from wholly disinterested sources as to the efficiency of mechanical filtration as a means of purifying water seems likely to be remedied by the proposed tests at Louisville, Ky., described elsewhere in this issue. Mr. Chas. Hermany, M. Am. Soc. C. E., is Chief Engineer of the Louisville Water Co., and Mr. Geo. W. Fuller has resigned his position at Lawrence, Mass., as stated in our personal columns, to become Chief Chemist and Bacteriologist to the company during these tests. The experiments will be under all the conditions of actual practice, so far as we are informed. Two of the manufacturers of mechanical filters have already erected plants with daily capacities of 250,000 gallons, and we infer that other companies will enter the competition.

The population of Louisville in 1890 was 161,129, and the average daily water consumption in 1893 was 13,400,000 gallons. Water is pumped from the Ohio River, which carries a large amount of matter in suspension. This matter the filters will be called upon to remove, together with such bacterial life and food as the water may contain. Hence an opportunity will be given Mr. Fuller to study mechanical filtration in various aspects, an opportunity which those who have watched his work in water and sewage purification at Lawrence know will be improved to the utmost.

We trust that the details of these experiments will not suffer the fate that befell those made at Providence two years or so ago by Mr. E. B. Weston, M. Am. Soc. C. E. Mr. Weston made an extended series of experiments on slow sand and mechanical filtration, and reported on the same at length; but thus far, through no fault of his, the report has not been made available to the public.

The engagement of an eminent English hydraulic engineer, Mr. Jas. Mansergh, M. Inst. C. E., of London, to report on the water supply of Toronto, Ont., for a fee of $15,000 will doubtless give rise to much comment among engineers on this side of the Atlantic. The incident is an example of the necessity which often arises in municipal affairs to bring in some one from a great distance to convince the people of the wisdom or necessity for a given line of action. Prominent engineers in both the United States and Canada have fully investigated the water situation at Toronto, including among others Messrs. Rudolph Hering, Samuel M. Gray, Wm. J. McAlpine and the present city engineer of Toronto, Mr. E. H. Keating.

Messrs. Hering and Gray recommended a continance of Lake Ontario as a source of supply and the carrying of the city's sewage to a greater distance from the water-works intake than the present points of discharge. Some improvements to the intake were carried out in general accordance with these recommendations. Late in 1892 a part of the intake pipe rose to the surface of the bay, and in 1893 Mr. Keating advised that a tunnel be built beneath the bay and that the old wooden conduit across the island be replaced with one of steel, together with minor improvements in the intake. He said he deemed it unsafe to rely upon the existing intake conduits and advised that work be started at once, stating that construction would probably take two years. Had his recommendations been carried out, it is probable that this city of 200,000 inhabitants would not now be relying for drinking water upon a supply brought from adjacent municipalities in trolley sprinkling cars and distributed in street watering carts, as was reported in our last issue, owing to a reappearance of the intake at the surface, causing breaks in the pipe which admit the sewage-polluted water of the bay. The people voted down a proposed appropriation for improving the works, and now the city council is bringing a man from London to tell them, perhaps, what their own city engineer and other engineers not far away have already set forth in detail. If Mr. Mansergh should advise the abandonment of the present supply and the introduction of a gravity supply from some of the possible but distant sources, he would only be duplicating advice already given by other engineers, but reported against by Messrs. Hering, Gray and Keating. This brings up a point which doubtless has had much to do in preventing an improvement in the means for drawing water from the present source. One or more companies have been trying for the past few years to get the city to contract for water by the million gallons, delivered from some of these gravity sources or from proposed wells.

Considering the number of reports which have been before the people, and the rivalry between the friends of the Lake Ontario system and those who favor gravity sources of supply, it is perhaps not surprising that an appeal should be made to a new adviser and that he should be brought from such a distance. It is of course a far different thing for a Canadian city council to engage an English engineer than it would be for a city of the United States. But notwithstanding all this, it will be a question with many whether better advice could not be given by an engineer familiar with the methods employed in securing water from the Great Lakes, which vary so widely from any possible English practice. It will be interesting to see how an English engineer will look upon the use of the same body of water for sewage disposal and water supply.

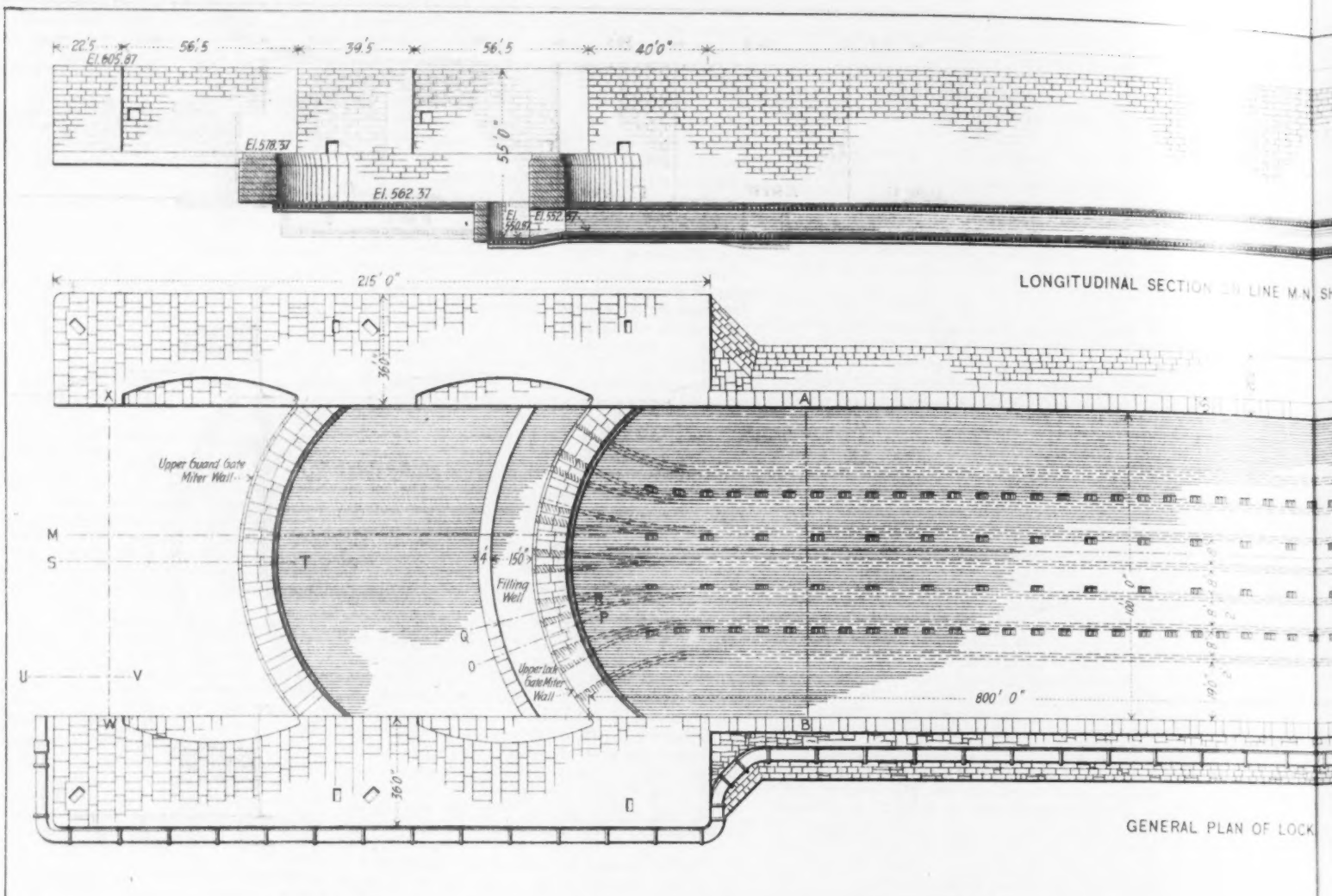
The payment of premuims for excess of speed over contract requirements in war vessels was prohibited by Congress a year or so ago, the action being brought about as the result of a great deal of newspaper agitation in which the payment of such premiums was denounced as a scandalous system. We pointed out at the time (Eng. News, Feb. 8, 1894) that the principle involved in the payment of speed premiums was an excellent one, and admirably suited to obtain the best results at the minimum total cost to the purchaser. Congress, however, in its wisdom decreed that no more speed premiums should be offered; and what Congress says, goes. In the proposals now asked for the new battleships, therefore, the naval authorities have substituted a penalty for deficient speed in place of a premium for an increase, which amounts of course to the same thing as the old "speed premium," save that it calls it by a different name.

The naval contractors would as soon bid on a vessel to make a guaranteed speed of 16 knots and submit to a penalty of $100,000 for every knot which the vessel falls short of this as to bid on a contract speed of 14 knots with a premium of $100,000 per knot for excess of speed. The two systems have this point of difference, however, that however much the newspaper economist may object to the payment of "premiums" he can certainly find no fault with the assessment of penalties. There is sometimes a good deal in a name.

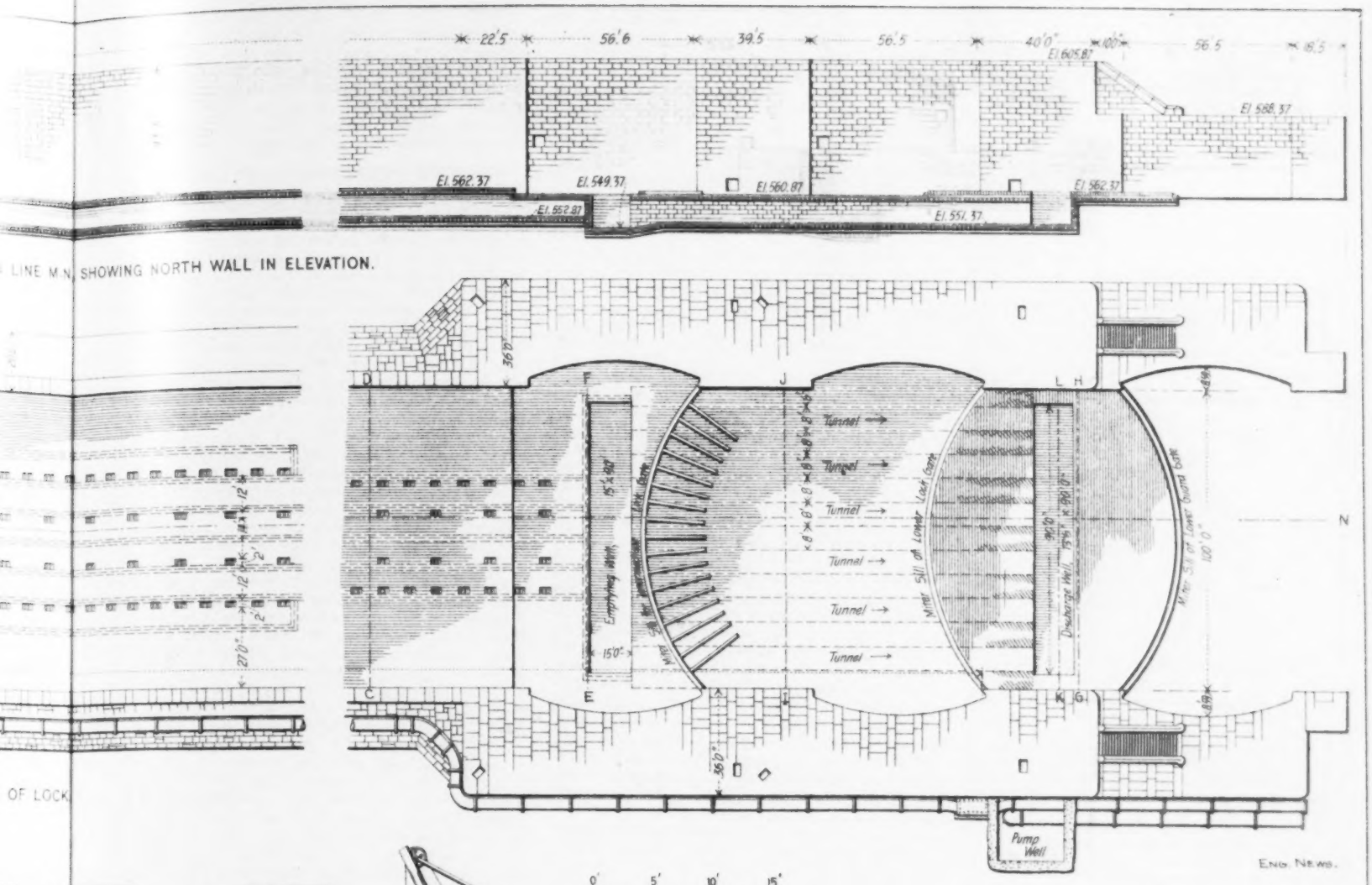
Robert E. Peary, C. E., U. S. N., is on his way home, after nearly four years of practically continuous study and exploration in the Arctic region. Despite the exercise of every reasonable precautoin and the display of indomitable energy and perseverance and wonderful endurance, he did not succeed in advancing as far as he hoped towards the North Pole. But he has done work of much more real use in mapping out regions hitherto unknown; and he and those with him have made invaluable studies of the people of this Arctic land and have done the best work ever yet performed in adding to our knowledge of the zoology, botany and glacial phenomena of North Greenland. The thrilling accounts of his last season's efforts and misadventures, in pushing to the northernmost limits of the Greenland ice-cap with but two men, food caches buried beyond recovery beneath unexpected depths of snow and under conditions which even the Eskimo dog could not survive, are sufficient proofs that Mr. Peary accomplished even more than could be expected under the circumstances.

The expiration of the term of office of the present Board of Trustees of the Sanitary District of Chicago and the election of a new Board to take its place are being discussed by the Chicago papers in anticipation of the political conventions to be held early next month. Thus far it appears a little doubtful just what stand the press of that city will take, although the general opinion seems to be that most, if not all, of the members of the present Board should be re-elected. There are many reasons why this should be done, and not the least of them is the non-partisan attitude of the Board to which some of the machine politicians of Chicago are objecting. No new Board, however excellently composed, can take up the work and carry it on in as satisfactory and intelligent a manner as the Board whose members have been closely associated with all the details of the enterprise since its beginning. A Board made up entirely of new members would be ignorant of the policy and attitude of the present Board in disputes now pending and unfamiliar with the methods of handling the work. The disruption of the present engineering force, the carrying over of unbalanced accounts, and a dozen other things which might follow the advent of a Board made up of new members would be apt to lay the District open to claims for extras and a multitude of annoyances and expenses. No one questions the honesty and faithfulness of the present Board or its ability to carry through the work to the end as satisfactorily as it has done so far; and certainly the discharge of a proved and faithful servant for an untried stranger is not to be commended for selfish reasons alone, let alone the injustice of the action.

Unfortunately, however, the re-election of the present Trustees depends on their nomination by the political conventions; and the political leaders who rule these gatherings would like very much, we presume, to try whether a Board made up of new men might not be induced to use the canal enterprise in the party interest. It may not be possible for the friends of good government and the taxpayers who are vitally interested in the economical completion of the Drainage Canal to secure the re-election of all of the present Board of Trustees; but in any case they should see to it that the one engineer member of the Board, and the man to whom the inception and inauguration of the work is really due, Mr. Lyman E. Cooley, M. Am. Soc. C. E., is renominated and elected. Mr. Cooley has been closely identified with the Drainage Channel since its inception, his knowledge of all questions relating to its construction is minute, and his energy and good judgment in pushing the work have been exceeded by none. It is entirely to the interests of the citizens of the Drainage District



CROSS-SECTIONS THROUGH FLOOR OF LOCK AT VARIOUS POINTS, SHOWING CULVERTS FOR FILLING AND EMPTYING LOC



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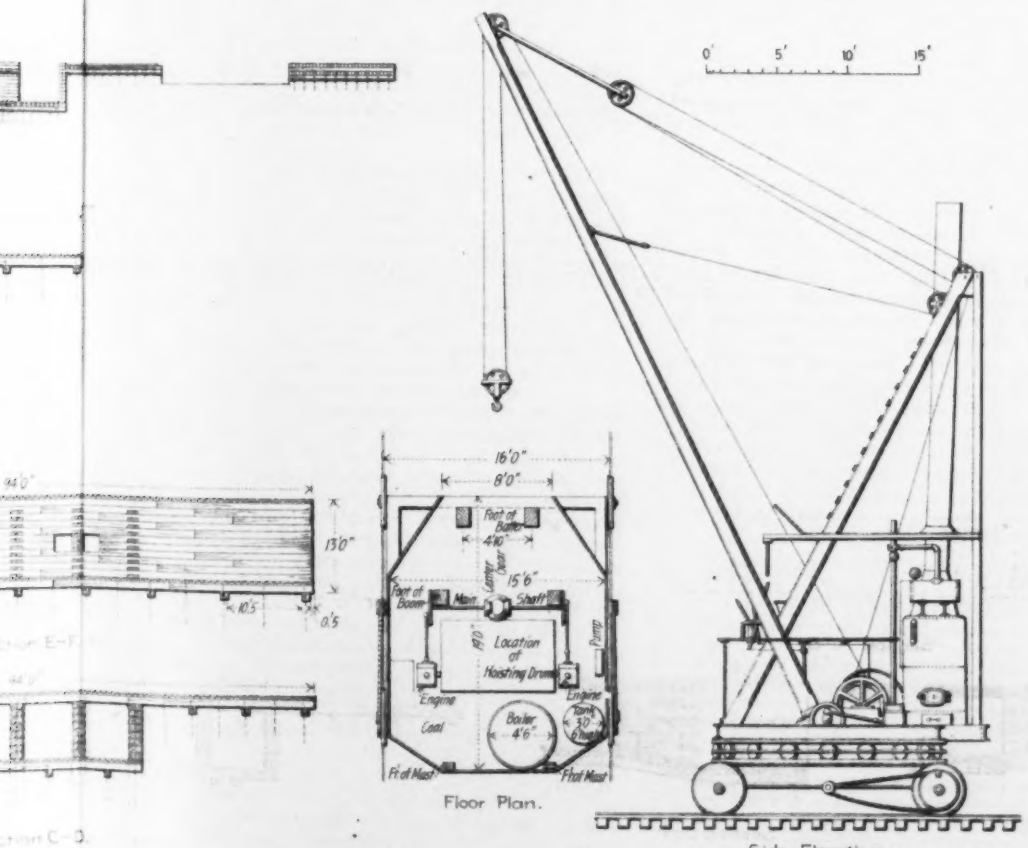
OF LOCK.

ENG. NEWS.



McMYLER TRAVELING CRANE USED IN LAYING MASONRY OF LOCK WALLS.

UNITED STATES GOVERNMENT LOCK AT SAULT STE. MARIE, MICH.

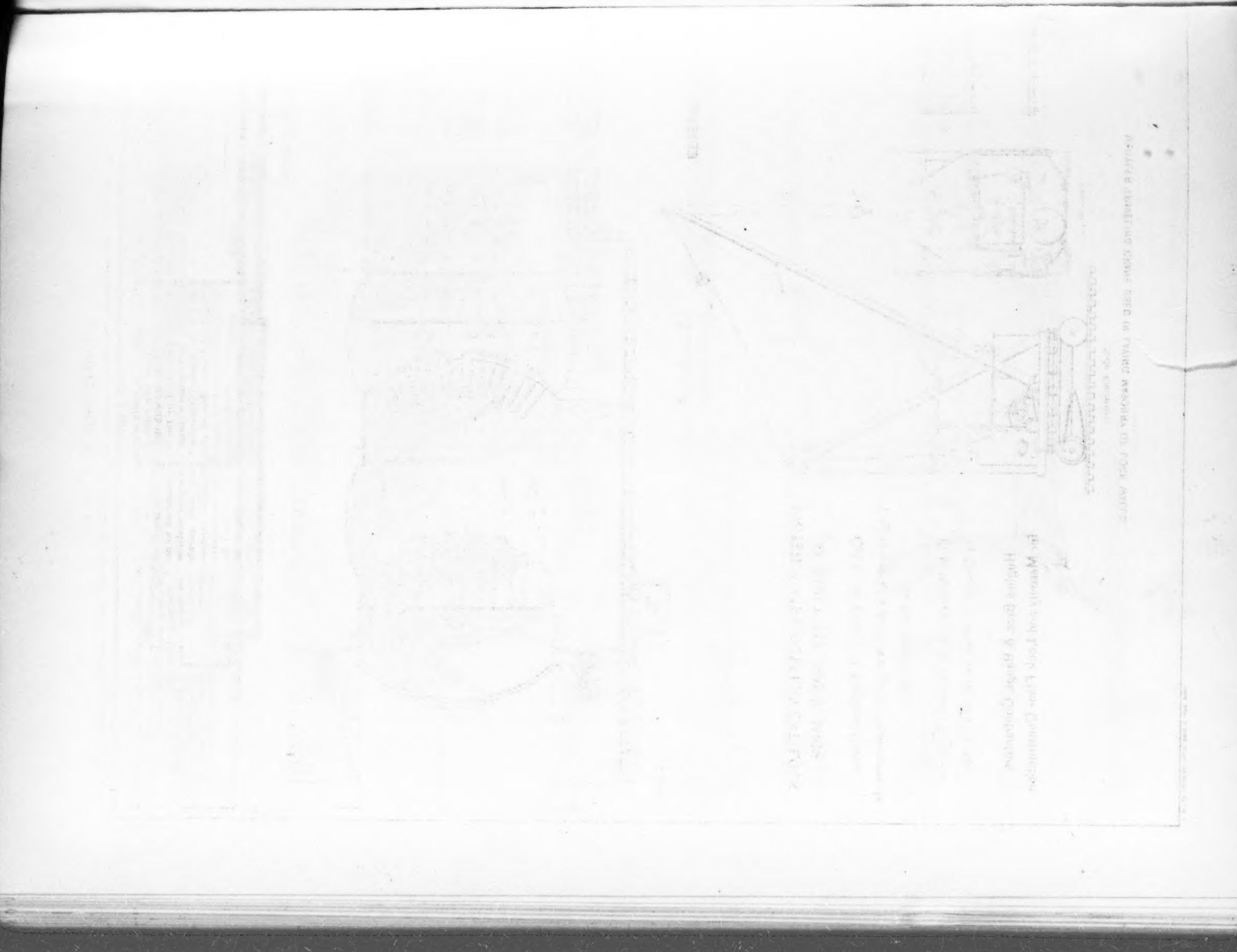
Col. O. M. Poe, U. S. Engineer Corps,
Engineer in Charge of Navigation Improvements
on the Great Lakes.

E. S. Wheeler, U. S. Assistant Engineer
in Charge of Work on St. Mary's River.

Hughes Bros. & Bangs, Contractors
for Masonry and Lock Floor Construction.

TYING LOCKS.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.



that he be re-elected for another term. The engineers of Chicago, who are in a position to appreciate the value of an engineer's services in such a position, ought to use every endeavor to secure Mr. Cooley's return; and we even hope that the press of that city, or at least the more influential journals, will in this particular at least lay aside the claims of party and unite to favor Mr. Cooley's re-election.

THE BROOKLYN AND PORT ROYAL DRY-DOCKS.

The four new battleships, almost completed by the United States at a cost of about $4,000,000 each, are American throughout—in design, material, armament and workmanship. When finished they will be the best of their class and the equal, at least, of any warships built abroad. Each will carry a main battery of four 13-in., eight 8-in. and four 6-in. guns, in addition to a powerful secondary battery. The plans were made in the Bureau of Construction at Washington; the armor was furnished by the Bethlehem Iron Co. and the Carnegie Steel Co. It was manufactured out of American steel and specially treated by an American process and the guns and machinery are likewise American in every detail. This is doing pretty well for a country that was advised a few years ago to buy its ships and guns ready-made "from those who knew how to make them," and which less than ten years ago did not possess a shipyard fitted for turning out anything larger than an ordinary cruiser. To-day, at least four American shipyards are equipped with plants capable of constructing the largest warships afloat. Three out of these four battleships will be in commission within the next twelve months—the "Indiana," "Massachusetts" and the "Oregon," and two more battleships were ordered by the last Congress and are to be completed within three years.

But in contrast with the efficiency shown in the designing and building of the great battleships is the inefficiency which has been manifested in the construction of dry-docks large enough to receive these vessels. Four or five years ago the Navy Department authorized the construction of two new timber dry-docks on the Atlantic coast, with dimensions sufficient to accommodate the new battleships, the construction of which had just been decided. These docks were thus early begun in order that they might be finished in abundant time to receive these vessels.

One of these docks was at Brooklyn and the other was near Port Royal, in South Carolina. The history of these docks, which are still incompleted, should not be pleasant reading to the heads of our Naval Department at Washington and to the line officer of the Navy who nominally and officially heads the Bureau of Yards and Docks, and who is innocently perhaps, but directly responsible for the failure which compels the builder of our first American battleship to send it to an English dockyard for ordinary cleaning.

Thanks to political intermeddling and party pressure more than to any other one element, the contract for the Brooklyn dock was let to inexperienced parties, and after a long delay and after abundant and uncalled-for concessions made to the contractor, it has been relet to another party, who seemingly is having similar trouble with the construction. The contract for the Port Royal dock was let about four years ago after a call for bids accompanied by plans. We recall that the many plans submitted—some of them utterly absurd—were overhauled by a board of naval civil engineers. The lowest bid was thrown out on the ground of the utter incompetency of the contractor; but the second bid, though on a plan condemned by the engineers, was accepted by the Navy Department on the score of "economy," and the contract was let with some minor modifications of the original plan. A young and none too experienced engineer of the corps was put in charge, and construction was commenced. It now seems that the original plans have been carried out to all practical purposes, and, according to the late report of the examining board of engineers, the very palpable defects that do exist,and for docking purposes make the dock worthless just when it is badly needed, are due to the faulty original design.

We cannot help contrasting the finding of this Board of Inquiry with the action of the late Court of Inquiry called by the Navy Department to defend itself against a charge of structural weakness in the cruiser "Columbia." The court quickly found Captain Sumner guilty of official carelessness in not properly inspecting the Southampton dock before putting his ship into it, and fixed the responsibility and punished the man. But in the case of the Port Royal dock a mere board, which has no power to swear witnesses and go to the bottom of affairs, was convened, and though the fact of structural weakness was proved and admitted all department officials and the contractor were exonerated, and the defective plans were found guilty. This is a distinction with a difference that the Navy Department should be called upon to explain.

The natural query is, Who is responsible for the blunder for which the national government has paid out about $500,000, leaving out of consideration the national disgrace of being compelled to go to a foreign power for what Congress designed we should have at home. Looked at impartially, we can come to only one conclusion, and that is, that there is something radically wrong in the civil engineering control in the U. S. Navy Department. Contracts should not have been let upon faulty plans to inexperienced builders; and in all these four years some engineer connected with the Bureau of Yards and Docks should have found out that things were going wrong and should have stopped them. It is true that the Chief of the Bureau has visited the Port Royal dock at intervals; but we cannot learn that he has ever taken with him an experienced civil engineer, and being a line officer of the Navy, and not a civil engineer himself, he seems to have failed to note any deficiencies in plans or construction. The Secretary of the Navy is not an engineer, and was guided simply by a desire to economize; and he allowed his "economy" to push aside the advice of the board of engineers. Consequently we can blame neither of these officials for the failure to perform a duty entirely foreign to their training and experience. But we do roundly blame, as we have often done before, a system which makes such blunders possible and wastes the public funds. The experience at Port Royal and at Brooklyn shows that the Secretary of the Navy absolutely needs some one to steer him when civil engineering is involved; and the same experience proves that a chief of an engineering bureau who knows nothing about civil engineering is not a safe guide in such extremities. Had the Bureau of Steam Engineering and the Bureau of Construction and Repair of the Navy been under the control of inexpert chiefs, instead of being in the hands of the most capable and experienced men under each head, the story of our new navy would undoubtedly read very differently from what it does, and there would be no room for the remarks made at the head of this article. "Never send a tailor to do a shoemaker's work" is a bit of advice that our Navy Department can apply with profit—as far as the Bureau of Yards and Docks is concerned—and Congress should see that it is applied in the public interest and for our national credit.

LETTERS TO THE EDITOR.

LINES OF STRESS IN BEAMS.

Sir: The communication of Mr. Marston in Engineering News of Sept. 18 entitled "Lines of Stress in Beams" is very interesting and instructive. The resemblance between the curves determined by polarized light and the curves of maximum tension and compression given by the theory of internal stress does much to prove that the theory is correct as far as it goes. As explained by Mr. Marston, the difference between the curves as given by theory and as found by polarized light, is due to the local effect of the load. It is this local effect of the load which the theory has to leave out of consideration in order to reach general results. It is to be hoped that those in position to carry on the experiments with polarized light will be given every facility to do so. Thus it may perhaps be possible to discover the mathematical treatment of the subject when the local effect of the load is taken into account.

Since theory indicates that the lines of maximum shear would be at angles of 45° with the lines of maximum tension and compression, the lines as given by Mr. Marston also corroborate the lines of maximum shear as sketched by the writer in Engineering News of Aug. 1, 1895, to which reference is made.

The resemblance between the theoretical lines and the lines as determined by polarized light is very striking indeed, when a point near the abutment is considered. Here, as is assumed by the theory of internal stress, the beam is only subject to bending moment and shear.

C. M. Broomall.

Media, Pa., Sept. 19, 1895.

ENGINEERS AND RAILWAY CONSTRUCTION.

Sir: The railway journals show that about 670 miles of railway was constructed up to July 1 of the current year. I constructed 14 miles of this myself, making the reconnaissances, running both transit and level; in short, having no educated assistance whatever. This is about 2% of all of the main line track laid in the United States during that time. The fact that 50 engineers could have done all of the work necessary for railway extensions during the first half of this year is the most forcible illustration I have seen of the depression in that branch of our business. If 50 engineers did this work, what became of the thousand or so others who are usually engaged in it? I am interested in this question, for I may be one of the "outs" next year, and would appreciate a suggestion as to how to "make both ends meet."

Yours truy, Railway.

(The great growth of electric railways for city, suburban and country railways, accompanied by a call for more scientific methods of construction, has undoubtedly opened up a new and fairly wide field for engineers, while the construction of water-works, sewers, irrigation works, etc., is increasing to such an extent as to attract many engineers to enter these various fields.—Ed.)

THE COST OF STREET SPRINKLING.

Sir: Answering an inquiry of some of your subscribers (Eng. News, July 18 and Aug. 15, 1895) as to the cost of street sprinkling, I herewith send cost in the city of Indianapolis for the years 1892, 1893 and 1894. The streets sprinkled are all graveled, and many are protected by shade trees. The sprinkling season is from April 1 to Oct. 31. Each street was sprinkled three times daily, Sundays and holidays included. A small portion of the business district, with stone-paved streets, was sprinkled four times a day. Contracts are let for the season at so much per 10,000 sq. ft. The street intersections are paid for by the property abutting the street. The figures for the years given are as follows:

Year.	Lin ft.	Sq. ft.	Property front., ft.	Total cost.	Cost per ft. of frontage cts.
1892	383,472	14,979,506	672,057	$67,897	10.22
1893	495,704	17,234,141	854,761	67,913	8.10
1894	481,902	17,473,906	839,092	50,937	6.07
Average	453,692	16,562,517	781,970	$62,219	8.13

	Gallons of water used.	Gallons per sq. ft.
1892	105,515,000	7.05
1893	122,384,000	7.10
1894	110,733,000	6.33
Averages	112,877,333	6.81

The cost per front foot means cost to property abutting on the street, or an average cost of 8.13 cts. per ft. on each side of street. Water is measured and paid for by the contractor.

Respectfully, M. M. Defrees.

Indianapolis, Ind., Sept. 13, 1895.

THE REACTIONS OF PARTIALLY CONTINUOUS DRAWBRIDGES.

Sir: The article of Professor Merriman in your issue of Sept. 5 on the above subject makes, I think, some misstatements regarding the calculation of stresses in drawbridges. Adopting the principle of least work, Professor Merriman says:

> To develop the fourth condition, reference must be made to works on the mechanics of beams, where it is shown that the total internal work of the stresses is proportional to the sum of the squares of all the bending moments.

I agree with this statement, if to it is added: "Plus the sum of the squares of all the vertical shearing forces."

The deformation is proportional not only to the bending moments, but also to the shearing forces, both together forming the balance of the exterior forces. The work is, therefore, proportional to the sum of the squares of these quantities.

In a rolled or wooden beam the deformations due to shear are so small, compared with the remainder, that they generally can be neglected. In trusses this is altogether different. They amount, as a rule, to more than those from the bending moments. Researches made in this respect have proved that for most double-wing swing spans the dimensions required for the opened bridge make one span independent of the other when

the span is closed and loaded over its whole length.

It may be added that the same erroneous opinion prevails among some bridge designers in regard to continuous fixed trusses.

Very respectfully, Ch. Steiner.

116 Catherine St., Elmira, N. Y., Sept. 7, 1895.

(We have referred the above letter to Professor Merriman, and print his reply below.—Ed.)

Sir: The criticism in the letter of Mr. Steiner is a valid one from the standpoint of strict theory. The formulas presented for the reactions of partially-continuous drawbridges have the same and no greater validity than those for girders fully continuous. In my article in your issue of Sept. 5 the printer unfortunately omitted two and one-half words at the end of the fifth paragraph. This should read: "Thus the resulting formulas have the same validity as those generally used for continuous trusses." The influence of the webbing always modifies these formulas, the modification being the greater the greater the ratio of depth of truss to length of span. It is not possible, however, to ascertain the amount of this influence until a preliminary design has been made by the use of the ordinary formulas for the reactions.

The suggestion of Mr. Steiner that the total internal work should be made proportional to the sum of the squares of all the bending moments, plus the sum of the squares of all the vertical shears, is not a correct or practicable one. If the shears are to be taken into account, the true rule is a more complex one. As shown in the writer's "Mechanics of Materials," sixth ed., p. 264, the square of each bending moment should be divided by the coefficient of elasticity for tension, and by the moment of inertia of the cross-section, while the square of each vertical shear should be divided by the coefficient of elasticity for shearing, and by the area of the cross-section; then the sum of all these quantities represents the total internal work. This applies to a solid beam, but its application will lead to unmanageable formulas for the reactions.

The only practicable method of thoroughly dealing with a continuous, or partially-continuous, truss, is to determine the reactions by the common theory of flexure. From these the stresses and sections of the members are ascertained, and from these in turn the total internal work due to a given system of loads may be expressed in terms of one unknown reaction, which can finally be found. The design must then be revised, and new stresses and sections be determined, and the reaction be again found to a closer degree of approximation. The computations involved are, however, so lengthy that it is doubtful if they have ever been made in practice.

Yours truly, Mansfield Merriman.

Lehigh University, Sept. 14, 1895.

Sir: Having read with much interest Professor Merriman's valuable paper on "The Reactions of Partially Continuous Drawbridges," which appeared in Engineering News of Sept. 5, I desire to call attention to slight errors which I have noticed in the same.

In the algebraic expessions for the reactions of a partially continuous swing bridge, and also in the numerical example given to illustrate the same, the reaction D is given a positive value, and the reaction C is given a negative value. These values of C and D are wrong for a continuous bridge of this form—i. e., having three spans, but transferring no shear across the center span. C should have a positive value and D a negative value. This is evident, but it may be readily shown by taking moments about any reaction in an example. Thus, by taking moments about D in the numerical example given by Professor Merriman, it will be found that a condition of equilibrium at D requires the value of C to be positive. Similarly, it will be found that equilibrium of moments at A is given only when C is positive and D negative. The continuity in this form of swing bridge partakes rather more of the nature of a two-span than of a three-span continuous bridge. In fact, by putting n = 0 in Professor Merriman's formulas for the reactions, the values of the latter become identical with those given by the theorem of three moments for a continuous girder of two spans. In this form of swing bridge, with end spans of equal length, when the value of A is obtained, the values of B, C and D may at once be written, as follows:

$$B = P - A,$$
$$C = P(1 - k) - A = B - Pk,$$
$$D = -C,$$

which values are identical with those given by Professor Merriman's formulas, except as to the signs of C and D.

A few years ago, in investigating the stresses for this form of swing bridge, the writer concluded the above to be the correct values of the reactions B, C and D, as relating to the value of A, but failed to obtain a satisfactory expression for the value of A.

In the case of the double rolling drawbridge also, the values of the reactions B, C and D, as well as the value of the shear at M, may be written directly from the value of A.

In the formulas for the reactions of double swing bridges, after stating the value of A, Professor Merriman has referred the values of the remaining reactions to that value, in much the same manner as the values of B, C and D are given above. I desire to ask, however, if the values of C and D, in Case I. of a double swing bridge, should not be P (1 — k) — A and — P (1 — k) + A, respectively, instead of Pk — A and — Pk + A.

In deriving correct and simple expressions for the reactions of partially continuous bridges, Professor Merriman has performed a valuable service.

Benj. F. La Rue.

Scranton, Pa., Sept. 9, 1895.

(Professor Merriman replies as follows to the above.—Ed.):

Sir: I am glad that Mr. La Rue has pointed out the two errors. For the common swing bridge, with partial continuity over the pier, the signs of C and D should be reversed, so that the third formula shall read,

$$C = -D = \frac{P}{4 + 6n}(k - k^2)$$

For Case I. of the double-swing bridge the third and fourth formulas may be written in one, which should be

$$C = F = -D = -E = P(1 - k) - A.$$

These errors do not exist in the original investigation, and hence have not influenced the other formulas.

Yours truly, Mansfield Merriman.

South Bethlehem, Pa., Sept. 24, 1895.

MR. ATKINSON'S INVESTIGATION OF STEAM-BOILER PRACTICE.

Sir: I was very much interested in the letter of Mr. Edward Atkinson, of July 30, and your reply in your issue of Aug. 29.

While there was a line of semi-facetiousness in both, still the subject is one which you both recognize as of the greatest importance to everybody, not only to steam users, but to the inhabitants of every city and village. I read in a recent report of a city official a "recommendation" that the city place a "smoke consumer" on their power plant, as an evidence of good faith to the citizens in enforcing certain ordinances bearing upon the subject. It is possible that it never occurred to that official that he was advising the locking of the door after the horse was stolen, and, that, instead, he should have advised the remodeling of the plant so that practically no smoke would be made, to need consuming. I have long felt that nearly every one was needlessly extravagant in their use, or misuse, of fuel, and that much engineering ability was devoted to attaining a high standard of engine, and but very little to generating the steam to use in it. It is true, as you say, that circumstances will often affect the type of boiler to be used, but, be that as it may, when the type is decided upon, the all-important question remains: What kind of a furnace shall be put under or around the particular type of boiler, to give the best results, with the particular kind of fuel that must, or can, be burned?

I have seen but very few plants that have seemed to point to the desired end—i. e., perfect combustion in the furnace and the depositing of all refuse in the pit, rather than distribute it over the neighborhood, either by means of Mr. Atkinson's "monumental chimneys," or your "forced draft."

I trust, and believe, that Mr. Atkinson will succeed in gathering many interesting facts, and from them will deduct some certain "general principles," which, if followed, will greatly help all steam users. I shall watch for future communications on the subject with interest. Yours respectfully, Novice.

Salt Lake City, Utah, Sept. 10, 1895.

ANOTHER 50-YEAR FRANCHISE GIVEN AWAY.

Sir: In connection with what has been said in recent issues of Engineering News concerning the granting of franchises by towns and cities, I enclose you a rather lengthy contract lately made between the town of Fairhaven, Mass., and the Union Street Railway Co. This company operates about three miles of single track in the town, connecting it with the city of New Bedford, where it controls several more miles. The motive power has been recently changed to electricity, after considerable opposition on the part of the townspeople. Under the old contract, made in 1892, considerable trouble was had, owing to poor service and carelessness in maintenance of track, and this new agreement is intended to overcome these difficulties. The company, in return for receiving an exclusive franchise for the very long term of 50 years, agrees to pave all streets in which tracks are now or may be laid, from curb to curb, at the rate of at least 1,500 ft. annually. As the roadway hardly exceeds 25 ft. in width, it would not seem that a very high annual rental is paid especially as there is a very heavy summer traffic, and good patronage all the year round, which is likely to increase greatly in the next few years. Then again, the terms under which the paving is to be laid are rather indefinite. About all that is said is that the work shall consist of the best quality of granite blocks, laid according to the best practice of the city of New Bedford, which may not be the best by any means, nor suited to the needs of the town.

Several other parts struck me as being rather unsatisfactory for a contract for such a term of years. Although it is rather wordy, it looks as if the railway company could get out of keeping several of the conditions, if they chose. Altogether, it would seem as if the town were laying a good foundation for trouble in the future. Yours truly, G. E. Ellis, C. E.

Yonkers, N. Y., Sept. 1, 1895.

(That public franchises are public property and may be made an important source of income is now generally recognized, and it ought to be plain that no one at the present day, no matter what his foresight, can estimate the value which may be fairly placed on such privileges a generation hence. To grant a 50-year franchise under such conditions is to give away or sell for a song what might become an important source of public revenue in half that time, if the franchise were made to terminate after a reasonably small term of years.

It should be said in this connection also that the practice of taking payment for valuable street railway franchises in street paving is a relic of past conditions which ought to be discarded. It was proper enough in building horse railways that the company should pave the street between its rails and for a short distance on each side, but on an electric road there is no reason for making the paving of this part of the street different from that of the rest. If the franchise is worth paying anything for, the street railway company can as well pay in dollars and cents as in doing free paving, and the people can then form some idea of how much they are receiving in return for the privileges which they grant.—Ed.)

JOHNSON'S FORMULA FOR SHORT COLUMNS WITH ECCENTRIC LOADS.

Sir: Answering Professor Johnson's query in your issue of Aug. 29, I think that to be guided by judgment in dealing with the problem of eccentric loading is a safer and wiser course than a strict adherence to his rule.

The alleged theoretical accuracy of his formula, and not its practical safety, was the subject of my criticism. But the latter question having been raised, I would point out that the safest rule is not necessarily the one which it is wisest to follow. If it were, then a factor of safety of 10 would always be wiser than a factor of 4, a factor of 20 than a factor of 10, and so on. I cannot agree with his position that the influence which the connecting beams have in partially fixing the ends of columns is either too small or too uncertain in any case which can occur in practice, to make it safe to consider it. But waiving this point, there still remains to be considered the question, not mentioned by him, of the influence of the connections of the columns to each other. For a large proportion of the wrought iron and steel columns in architectural work, these connections are so made that the different columns in the same vertical line practically form one continuous piece. In fact, owing to the common practice of making the columns in double lengths, at about 40% of the floor lines, the material is actually continuous. Under these conditions, a load applied eccentrically to any one column will cause strains from flexure in all the columns in the same vertical line. It may happen, therefore that a column will have flexure strains from eccentric loading, even though the beams which connect directly to the column do not bring an eccentric load on it.

I some cases the arrangements of the beams may be such that the flexure strains from eccentric loading will be cumulative, while in other cases they will tend to neutralize each other. These facts are not consistent with Professor Johnson's theory.

As it is practically impossible in most cases to determine the strains theoretically, it is justifiable to use methods for obtaining the sectional area which are not theoretically correct, but which give a safe approximation, such, for instance, as an increase in the assumed load, or a reduction in the allowed unit strains. Another method would be to assume such values for Pe and V as would make the expression Pe V a safe value for the bending moment on the column, and then find hte area required on account of the bending moment by Professor Johnson's formula. Any method used should be subordinate to a skilled judgment.

Beside the question of strain there is the question of stability to consider. If the resultant of all the forces acting on the column, except those at the base, does not pass through the base, the column will have to be tied or anchored to a firm support, to make it stable. Cases of this kind occasionally occur in practice, even under the action of vertical loads only. The assumption that

all loads from the columns above are concentric, and all loads brought on at the several floors are eccentric (if so they be), is not, of course, correct in such cases. Yet the acceptance of this assumption as theoretically correct would be the logical, and I believe in many cases the actual, consequence of the acceptance of Professor Johnson's formula as "theoretically correct for architect's use." He supposes that the assumption is in accordance with the present custom. I should be surprised to learn that this supposition was correct. It certainly is not the practice among a large number of engineers and architects.

Respectfully, Henry S. Prichard.

Trenton, N. J., Sept. 12, 1895.

THE EFFECT OF THE CHICAGO DRAINAGE CANAL ON THE CANADIAN CANALS.

Sir: Many of your readers must be surprised at the attitude you assume regarding the threatened lowering of the water level of the Great Lakes by the absolute abstraction of water about to take place at Chicago. No doubt we all agree that Chicago needs cleansing in many ways; but whether this ought to be and can be done at the expense of every interest centering on these inland seas is very doubtful. The argument which you advance, and the one also given by the Chicago Drainage Commission in their reply to the adverse report of the U. S. Engineers, that, "because lake vessels must now leave a foot or so margin in the draft of their vessels, therefore 6 ins. lowering of the surface of the lakes, absolutely without reference to any other fluctuations, is not of any moment," or words to that effect, is no argument at all. It is a childish quibble not worthy of the men who advance it. Vessels will still have to leave the same margin as before, in addition to whatever loss of depth they may sustain by the proposed robbery. Your lake cities are very much interested in this matter, and Canadians generally felt that these interests were strong enough to see that justice would be done. But it seems such is not the case, and Canadians must demand justice. The Great Lakes do not belong to the United States any more than they do to Canada, and the abstraction of so much water, diverting it into another than its natural channel is always considered against common law, when one neighbor does it to the detriment of another. It remains to be seen whether the same does not hold good in an international question of a similar nature.

Our canal system, on which we have spent so many millions, will soon be completed to a uniform depth of 14 ft. from Port Arthur to the Atlantic. When it is complete we shall take a large share of the grain-carrying trade westward, and you must not expect us to stand meekly by and see the depth lowered 6 ins. or so without protest. That we have not done so in the past is because it seemed probable that the adverse interests in your own country would settle the matter equitably, and not because of lack of knowledge of the work going on, or a realization of the effect it would cause. It is a pity to mar the very interesting descriptions you are publishing weekly on the enterprising methods of construction being practiced on the Chicago Ship (?) Canal, but really, I think, the energy displayed there might better be devoted to doing something that will not cause injury to the interests of millions of people in order to benefit Chicago.

Yours sincerely, Cecil B. Smith, C. E.

McGill College, Montreal, P. Q., Sept. 7, 1895.

NOTES AND QUERIES.

R. L. J. desires the address of parties who will undertake the building of pontoon docks in Cuba.

J. M. B. writes that he is about to paint a wooden trainshed, having about 8½ acres of exposed woodwork under the roof. He contemplates using the compressed air method of painting described in Engineering News of Feb. 23, 1893, and desires the address of firms which will contract for work of this class. Letters to him may be addressed in care of this journal.

J. C. M. inquires concerning Dr. Angus Smith's process for coating water pipe. Dr. Angus Smith patented his process in England about 1850, and it was applied to the first coated pipes used in the United States, imported from Glasgow in 1858. His "coal pitch varnish" is distilled from coal tar until the naphtha is entirely removed and the material deodorized. He recommends the addition to this of from 5 to 6% of linseed oil. To coat the pipes, the pitch is heated in a suitable bath or tank to a temperature of about 300° F., and into this bath the pipes are immersed and allowed to remain until they, too, attain a temperature of 300° F. Mr. J. T. Fanning, in his "Water-Supply Engineering," states that a more satisfactory method is to heat the pipes in an oven to about 310° and then immerse them in the pitch-bath, which is maintained at a temperature of not less than 210°. The linseed oil has a tendency to float and separate from the pitch at high temperatures. An oil distilled from coal-tar is now more generally used. The pipes should be free from rust and absolutely clean before treatment.

Three of the receivers of the Northern Pacific R. R. Co. have resigned, Messrs. Thomas F. Oakes, Henry C. Payne and Henry C. Rouse. The reason given is conflict of authority between the U. S. Circuit Court in the state of Washington, and the U. S. Circuit Court in the eastern district of Wisconsin. Judge Hanford, of the former court, refused to recognize the primary jurisdiction of Judge Jenkins, of the latter, and ordered the receivers to do certain things which would place them in contempt of the latter court, by which they were appointed.

AS SEEN BY AN ENGINEER.

(Editorial Correspondence.)

The tour of your correspondent began at the quiet old town of Trenton, N. J., which is famous as being the leading center of the American pottery industry and as the location of two of the principal wire and wire-rope concerns, the J. A. Roebling's Sons' Co. and the Trenton Iron Co. Both of these companies report that they are now doing a brisk business, and that the long depression appears to be at an end. The Roebling Company is engaged exclusively in the manufacture of wire in its various forms, including insulated wire, telegraph cables, and wire rope of all kinds. One of its leading specialties is the furnishing of heavy cables for cable railways. A few days ago it filled an order for three miles of special submarine telegraph cable, which is both a sample of what the establishment can do when hurry is the word and of New York journalistic enterprise. The New York "Sun" desired a cable to run from the New Jersey shore to the chartered tug boat which carried its reporters sent to witness the America's cup yacht races. The order was received at 9 a. m. on Sept. 9, and the cable was specially made to fill the order and shipped at 12 m. on Sept. 10.

The Trenton Iron Co. not only makes wire and wire cables, but it has an engineering department which designs and contracts for plants of various kinds which use wire rope for hoisting and transmission. One of its recent achievements is the erection of a suspension cableway of 1,000 ft. span across the Connecticut River at Holyoke, to be used in the construction of the new masonry dam which is to replace the old timber dam at that place. A new system of carriers for the fall rope on the cableway is to be used, which is expected to considerably increase its efficiency. The main cables for the cableways supplied by the Trenton Iron Co., instead of being made of ordinary wire rope, are made of what is called the "interlocked" wire, the outer layer of the cable being composed of wires about ¼ in. diameter, alternating with rods of a trapezoidal form, which together form a much smoother surface for the wheels of the carriage to run on than the ordinary rope, and therefore are less liable to wear.

The wire ropes for transmission purposes made by this company are now made almost exclusively of steel, and it has been found that much smaller sheaves may be used for steel than for iron ropes. Mr. Wm. Hewitt, the Vice-President of the company, who is quite a mathematician, has developed a new formula for proportioning the sheaves, which is now used in the company's practice.

The works are just completing a plant for canal towage which is to be erected on the Erie Canal to give an experimental demonstration of the feasibility of the system. The plant is built from the designs of Mr. Richard Lamb, Assoc. M. Am. Soc. C. E. The system was described by him in a paper read a year ago before the American Society of Civil Engineers.

An interesting novelty in excavating apparatus has recently been introduced by the Trenton Iron Co. known as the Hall Excavator, which is remarkable for its simplicity and its small first cost.

The 20 × 42-in. Corliss engine at these works is famed throughout the engineering world for its high speed. Although it has been run for about 20 years at the phenomenal speed of 160 revolutions per minute, it is still running, and on occasional orders it has been speeded up to the extraordinary number of 190 revolutions, or 1,330 ft. piston speed, per minute. It was formerly used to drive a wire-rod train, rolling rods from 1½-in. billets, but some time ago the mill was enlarged so as to roll from a 4-in. billet down to No. 4 rod. An accident happened which caused the engine to run away and burst the flywheel. A new flywheel was substituted of smaller diameter, which itself is a novelty. It is 10 ft. in diameter with 30 ins. width of face, and with a rim of the unusual thickness of 8 ins. It has eight spokes, which are correspondingly massive. The rim velocity of this wheel, even at the exceptional speed of 190 revolutions, is less than 6,000 ft. per minute, which is considered quite safe. The wheel is made in two halves, connected by heavy bolts. The belt driven by this wheel is provided with an improved form of belt tightener. The wheel of the tightener is carried by two swinging arms, which are controlled in their range of swing in both directions by heavy coiled springs, which entirely prevents the tendency of the tightener to pound upon the belt.

It is remarkable that after the engine had been running for over 10 years at a speed of 160 revolutions per minute, there was no other Corliss engine in the country running over 100, and engine builders and users seemed to have decided that the Corliss engine was necessarily a slow-speed engine, and that it should not be run over above 80 revolutions per minute, especially in sizes of 42-in. stroke and upwards.

Lambertville, N. J.—A short stop was made at Lambertville, en route to Easton, but nothing of especial interest in the engineering line was found. The shops of the Belvidere Division of the Pennsylvania R. R. are here, and a couple of paper mills. The town is an example of many towns throughout of the country, which look just as they did 20 years ago. The tendency of population to the cities leaves the small towns out in the cold, and they become of more interest to the antiquarian than to the engineer.

The Blast Furnaces of the Lehigh Valley.

The Lehigh Valley blast furnace district extends from Riegelsville, Pa., on the Delaware River, 10 miles south of Easton, to Parryville, on the Lehigh River, about five miles south of Mauch Chunk. It includes, in addition to the furnaces in the valley itself, some furnaces located a few miles distant from the Lehigh River, on the branches of the Philadelphia & Reading R. R., leading to Philadelphia and to Reading; such as the furnaces at Bingen, Hellertown, Alburtis, Emaus and Macungie.

The writer visited the principal furnaces of this district in July, 1873, just two months before the failure of Jay Cooke & Co., which was the beginning of the panic of 1873 and of the six years of trade depression which followed it. At that date the Lehigh Valley was the most important iron-producing district in the United States, and the furnaces were all, or nearly all, running, and presumably making money. Vast changes have taken place in the district since that time. Improvements in construction and in the driving of furnaces have been made to such an extent that the average daily product of a furnace is more than four times that of 20 years ago. The development of mines in the Lake Superior region and of iron production in the South have all been factors which have forced upon the Lehigh Valley furnaces a struggle for existence. During this struggle many once flourishing companies have succumbed, and many furnaces which were running in 1873 have been abandoned. In many cases a pair of furnaces have been replaced by a single furnace which makes twice as much iron per day as the two old furnaces made together. In the old days it was customary for the furnaces to have open tops, through which a great volume of flaming gas escaped, lighting up the country at night for miles around. The furnaces also had open fronts—that is, rectangular chambers in front of the hearth, closed in front by a wall and on top by a removable plate. Twice a day the blowing of the furnace was stopped for perhaps half an hour, when the plate was taken off, and men with long bars "worked" the furnace—that is, they pulled out a mass of hot but unfused slag mixed with particles of coal, which it was believed would not melt, and had to be thus removed. Now all the furnaces have closed fronts, and everything that is put into the furnace escapes either from the top in the form of gas or from the bottom through the iron and cinder notches in the form of melted iron and slag.

Name of works or company and location.	No. of furnaces.	Size of furnace, ft.	In blast.	Out of blast.	Annual capacity, gross tons.
Durham Iron Works, Riegelsville, Pa	..	75 × 19	..	1	38,500
Andover Iron Co., Phillipsburg, N. J	..	75 × 18	..	3	45,000
		75 × 17			
		60 × 18			
Glendon Iron Co., Easton	..	63 × 15	1	3	90,000
		81 × 18			
		80 × 18			
		72 × 18			
Lucy Iron Co., Glendon	..	65 × 14	..	1	....
Coleraine Iron Works, Redington	2	60 × 17	..	2	40,500
Northampton Iron Co., Freemansburg	..	65 × 15	..	1	....
Bethlehem Iron Co., South Bethlehem	..	61 × 15	3	3	120,000
	4	70 × 16			
Bethlehem Iron Co., Bingen	..	65 × 16			
Lehigh Steel & Iron Co., Allentown	..	65 × 16	1	1	37,000
		60 × 15			
Allentown Rolling Mill, Allentown	2	65 × 16	..	2	24,000
Allentown Iron Co., Allentown	..	60 × 16½	1	1	60,000
		60 × 17			
Crane Iron Co., Catasauqua	2	75 × 18	2	2	135,000
	2	60 × 16			
Thomas Iron Co., Hokendauqua	..	80 × 17	3	2	200,000
" " " "	2	60 × 17			
" " " "	2	65 × 17			
" " " Alburtis	..	60 × 14	2	..	
		60 × 16			
" " " Glendon	..	65 × 16	1	..	
" " " Hellertown	2	60 × 16	1	1	
Coplay Iron Co., Coplay	2	55 × 16	..	3	34,000
		75 × 15			
Carton Iron Works, Parryville	..	52 × 14	1	1	48,000
		65 × 14			
Philadelphia & Reading Coal & Iron Co., Emaus	..	66 × 16	..	1	29,000
Macungie Iron Co., Macungie	..	56 × 16	..	1	20,000
Totals	..	.....	16	29	

The furnace tops, too, are all closed, and all the escaping gases are led through iron flues, lined with fire-brick, to the ovens, in which they are burned to heat the blast, and to the boilers. The furnaces have been increased in size also, from a height of 50 or 60 ft. to 70 or 80 ft., and from 14 or 15 ft. diameter at the "bosh" or widest part to 17 or 18 ft. The results of all the improvements in construction and in methods of driving have been to reduce the fuel consumption per ton of iron from two tons or more down to about one ton, and to reduce the labor cost per ton of iron from over $2 to about $1. The necessary condition of continued existence of any furnace in the Lehigh Valley has been the spending of enough money to modernize the plant, and those companies which were not provided with sufficient surplus capital to do this have been compelled to suspend operations.

The accompanying is a tabular statement of the existing furnaces in the Lehigh Valley:

Of the furnaces given in this list as out of blast, some are now being repaired and will be put in blast as soon as possible—viz., the Durham furnace, one of the Andover furnaces, one Glendon, one Allentown Iron Co., one Crane, and one Thomas, or six in all. When these are put in blast the district will then have 22 furnaces in blast and 23 out. Of the furnaces which will then remain out of blast, a few might be started after the usual and ordinary repairs, but the majority are small furnaces and would require considerable alteration before they could be run in competition with the newer furnaces. The following notes concerning some of the furnaces will give an idea of some of the changes that have taken place and are still in progress in the district.

The Durham furnace is one of the first of the modern furnaces. It was built about 20 years ago on the site of two old furnaces which were taken down. The Andover furnaces are of old style, partially modernized. One of them will be put in blast about Nov. 1; the others will require extensive repairs before they can be run again. Of the Glendon furnaces, one is almost ready to go in blast, in addition to the one that is now in. The other two will require considerable repairs. The old No. 4 Glendon furnace at South Easton was torn down in 1890. The Lucy furnace at Glendon and the Northhampton furnace at Freemansburg were leased a few years ago to the Bethlehem Iron Co. They may be again put in blast if the price of iron continues to advance. The Coleraine furnaces at Redington have been out of blast for some years, and there are no signs at present of their being repaired. The furnaces of the Allentown Rolling Mill have been out of blast for some years, and they are tightly boarded up. They are old-style furnaces and there are no signs of their being again started. The rolling mills of this company near the furnaces are also idle. The mills are very extensive, and were formerly prominent in the iron rail business, but they are now out of date, and it is doubtful if they will ever run again. The Allentown Iron Co. has now only two furnaces, three old furnaces having been torn down. With the progress of improvement, a modern furnace requires at least twice as much room as an old one for stock room and casting house, and consequently when a plant consisting of five old furnaces in a row is to be modernized it is necessary to tear down some of them to make room for those that remain. The Crane Iron Co. has likewise torn down one of its furnaces to make room for one of the others. The Crane Co.'s works are the oldest in the valley. The first furnace was started in 1840. The Thomas Iron Co., one of the most famous concerns in the valley, for many years had six furnaces in a row. Their No. 1 furnace, formerly 60 × 16 ft., has been rebuilt and made 80 × 17, and No. 2 furnace adjoining has been abandoned. The new furnace has now the best record of the Lehigh Valley furnaces, over 1,100 tons having been made in one week. This record was made with iron hot-blast stoves. It is intended to remodel the remaining furnaces and ultimately to have a plant of four large furnaces instead of the original six. One of the present furnaces has firebrick stoves, and the others will probably also be furnished with them.

The Thomas Iron Co. has been one of the most uniformly prosperous companies in the district, and it has always been able to run some of its furnaces throughout the times of greatest trade depression. Its management has been eminently conservative, and to outward appearance even "old fogy." But few alterations have been made in the last 20 years. Only one of the furnaces is equipped with firebrick stoves, and the modernizing of the whole plant is only begun. But the plant was so well built, and the equipment was so effective, the engines being the largest blowing engines in the country, and the boilers and ovens being of ample capacity, that few alterations were needed. The company kept to its one business of making and selling pig iron, and acquiring a first-class reputation in the market, owning its own mines in Pennsylvania and New Jersey it has prospered while many of its neighbors have fallen. The success of its new No. 1 furnace and the contemplated remodeling of the whole plant are evidence that the company has both enterprise and the surplus capital necessary to keep up with the march of improvement, and, that it, will continue to make pig iron as long as any is made in the Lehigh Valley.

Of the three furnaces at Coplay, one of the small ones is on the list of the American Iron and Steel Association as abandoned. The other one of the pair looks as if it also would never run again. The larger furnace would require extensive repairs. These furnaces have been out of blast for about four years.

On the whole the appearance of the blast furnaces in the Lehigh Valley district is rather melan-

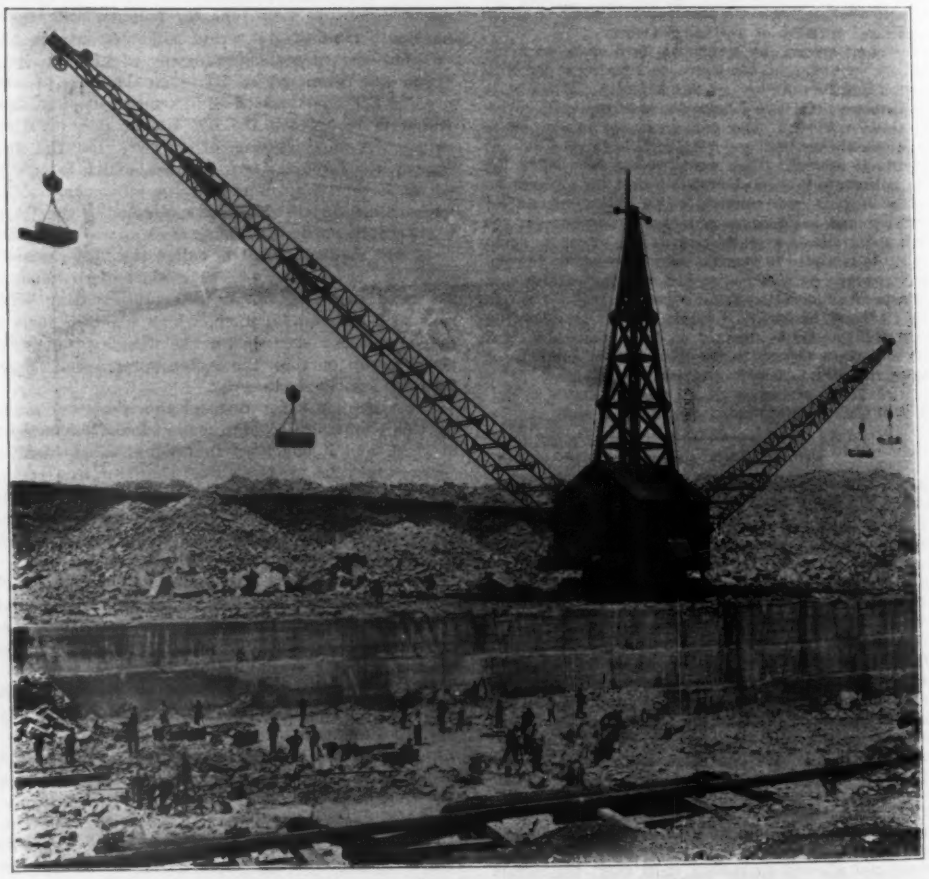


FIG. 82. DOUBLE STEEL BOOM TRAVELING DERRICK FOR REMOVING ROCK, SECTION 14 CHICAGO DRAINAGE CHANNEL.

cholv, less than one-half of the furnaces being in blast, although prices of pig iron have greatly advanced during the past three months. There is a hopeful prospect for the future, however, for those furnace companies which have sufficient reserve capital to remodel their furnaces in the latest style so as to make them economical of fuel and labor. The hermatite ores of the vicinity are still far from being exhausted. Some ores may yet be obtained from New Jersey. Freights on Lake Superior ores from Buffalo and on New York ores from Lake Champlain are not excessive. Foreign ores are also brought into the district to some extent. The coal-carrying railroads have reduced their rates, so that coal freights are no longer the burden they once were. The furnace company, therefore, which has a modern plant and no bonded debt will continue to make iron notwithstanding the competition of Southern furnaces. During the extreme depression this competition was so intense that Southern pig iron was sold even in the Lehigh Valley itself, but since the recent advance the market for Southern iron elsewhere has so much improved that the Lehigh Valley furnaces now have a free market in their own territory. In fact, the demand for Bessemer iron at Pittsburg is so great that Lehigh Valley furnaces have been solicited to make Bessemer iron for that market.

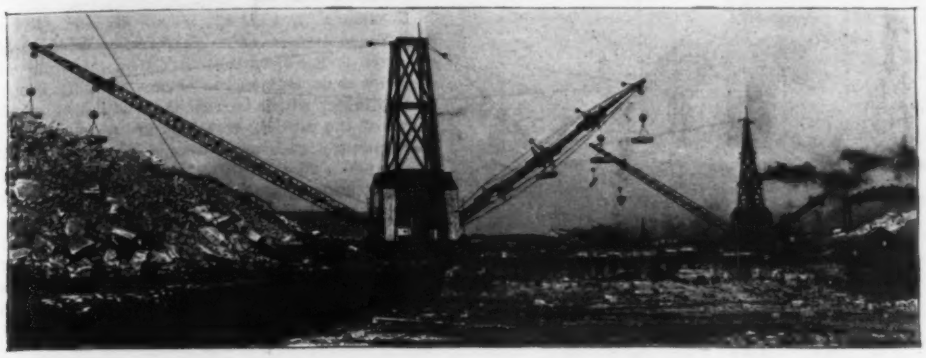


FIG. 83. VIEW OF TRAVELING DERRICKS WITH ONE STEEL AND ONE WOODEN BOOM, SECTION 14.

The Bethlehem Iron Works.

These works have been by far the most progressive in Eastern Pennsylvania, and are a monument to American enterprise and engineering skill. In earlier times they were among the foremost in the manufacture of iron rails, and were one of the first establishments in the country to erect a Bessemer steel works. The steel mill originally had two converters, but was built large enough to allow for doubling the converter and mill equipment in the same building with scarcely any alteration. The four large blast furnaces, erected about 20 years ago, were of what was then the most advanced type, and their massive blowing engines are still models of good design and workmanship. The Bessemer steel mill, now containing four converters, is running partly on rails and partly on billets. For the latter the company has a large demand for numerous special purposes. When the United States government woke up to the necessity of building a modern navy and modern guns, the Bethlehem Iron Works prepared to build an entirely new plant, wtih open-hearth furnaces, hydraulic plant for casting compressed steel and forging it on mandrels for gun tubes, etc.; the largest steam hammer in the world, 125 tons, and the most complete machine shops for finishing both guns and armor plate. These new works have been engaged for some years on government work, and have now a large contract for finishing guns and armor plate, besides a contract for armor plate for the Russian government. In addition, they are doing a great amount of work for private parties, especially heavy crank shafts and screw shafts for marine engines. The shafting for the new steamers "St. Louis" and "St. Paul" was made at these works. The hydraulic forging with the 2,500-ton and the 5,000-ton presses having proved that armor plate could be more expeditiously forged by hydraulic pressure than even by the gigantic hammer, a 14,000-ton forging press was built, and it is now used in preference to the hammer. The use of nickel steel and of the Harvey tempering process have also had their greatest development at these works. Nickel steel is apparently only in its infancy. It will probably soon be used for many other purposes than for armor plate. Its properties are being thoroughly investigated in the physical laboratory by Mr. Maunsel White, M. Am. Soc. M. E., who is the company's engineer of tests. The progress of the Bethlehem Iron Works has by no means reached its limit. An extensive new steel plant is now being erected and will contain four 40-ton open-hearth furnaces, a universal mill for rolling structural plates, a mill for beams and other structural shapes, and a 128-in. mill for boiler and ship plates. The foundations are also laid for a 160-in. mill for rolling armor plate. When the structural mill is finished it will make an outlet for the raw steel made in the works in case the demand for armor plate and guns should diminish.

The credit for the great engineering skill shown in the design and construction of the Bethlehem works, even to the smallest detail, is due to Mr. John Fritz, who for over a quarter of a century was also their active manager. Three years ago he retired from the management, at the age of 70 years. He still resides in Bethlehem in excellent health, and that he may long enjoy it is the earnest wish of hundreds of engineers, who honor him not more for his eminence as an engineer, than for his character as a man and for those personal qualities by which he has endeared himself to them as counselor and friend.

THE CHICAGO MAIN DRAINAGE CHANNEL.

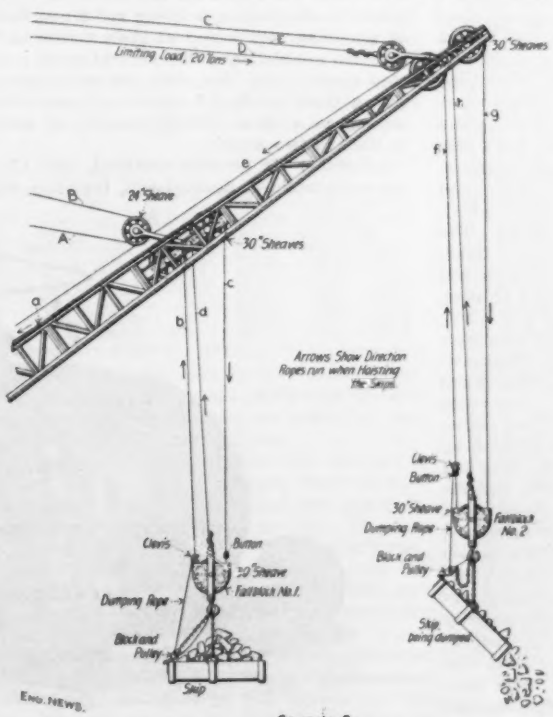
XIX.

Section 14.

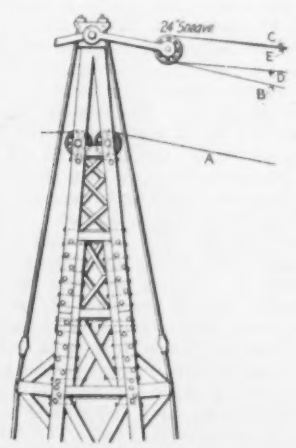
This section has been in the hands of two contractors since work was begun. The first contractor was the McCormick Construction Co., which was awarded the work July 13, 1892, at the prices of 20 cts. per cu. yd. for glacial drift, 73 cts. per cu. yd. for solid rock and $2 per cu. yd. for retaining wall. After some delay the contractors got into shape to do work, but owing to an insufficient plant, poor management, lack of money and various other causes, it was not pushed with the energy it should have been. The affairs of the company went from bad to worse, until finally, in November, 1893, they were placed in the hands of a receiver and all work was stopped. Upon notice of work being stopped the Board of Trustees sent a notice of action for forfeiture to the contractors, but before actual forfeiture was declared the receiver assigned the contract to Smith & Eastman, with the consent of the Trustees.

Up to the time when work was stopped 45,300 cu. yds. of glacial drift and 118,600 cu. yds. of solid rock had been excavated, and the terms of the assignment provided that the assignee was to continue the work in every respect as called for in the original contract and in conformity with certain additional stipulations which the progress of the work had shown to be necessary. These stipulations called for the construction of an embankment on either side of the channel. The embankment on the west side of the channel was required to run the whole length of Section 14 and 4,000 ft. west on Section 15, and to be 30 ft. wide on top and 8 ft. above Chicago datum. On the east side of the channel the embankment was to be of the same dimensions and to extend 4,000 ft. into Section 15, but to run only part of the length of Section 14. The material for constructing the embankments was taken from the main channel in part and partly borrowed, and an additional price of 16 cts. per cu. yd. was allowed for the east embankment and for 4,000 ft. of the west embankment.

With this modified arrangement the amounts of materials and prices stand as follows: 213,045 cu. yds. glacial drift at 36 cts. per cu. yd., 166,210 cu. yds. of glacial drift at 20 cts. per cu. yd., 1,023,500 cu. yds. of solid rock at 73 cts. per cu. yd. and 22,000 cu. yds. of retaining wall at $3.25 (estimated) per cu. yd.



Sketch 2,
Showing Operation of Dumping Device



Sketch 1,
Showing Top of Central Tower.

FIG. 84. SKETCHES SHOWING CONNECTION AND OPERATION OF FALL BLOCK ROPES, DUMPING DEVISE, ETC., DOUBLE BOOM TRAVELING DERRICKS.

The method of doing the glacial drift excavation and building the embankments calls for no especial mention. Steam shovels were used to excavate the material and load it into tramcars, which were hauled by locomotives to the dumping ground. Teams and small dump cars hauled up cable inclines were also used. At the busiest time, three locomotives, one cable incline, about 60 large and

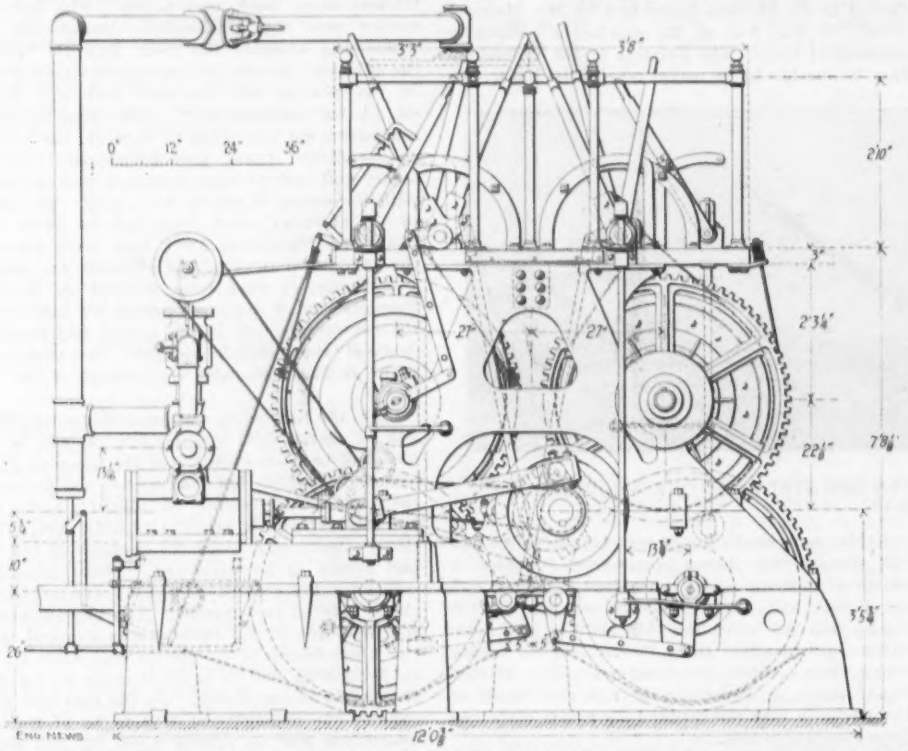


FIG. 85. HOISTING ENGINE FOR DOUBLE BOOM TRAVELING DERRICK SHOWN IN FIG. 82.
Gates Iron Works, Chicago, Ill., Builders.

15 small dump cars, two steam shovels and a dozen teams were used. The steam shovels were of the Giant type, manufactured by the Vulcan Iron Works Co., of Toledo, O., and the dump cars were manufactured by the Sheffield Velocipede Car Co., of Three Rivers, Mich. These cars proved very satisfactory both in their working and their durability. The capacity of the large cars is 5 cu. yds., or 20,000 lbs. The inside measurement of the box is 8 ft. × 9 ft. × 1 ft. 10 ins., and the height of the top of box above the rail is 6 ft. 11 ins., and the length over all is 13 ft. The wheels are 24 ins. in diameter, with 4 ins. tread, and weigh 318 lbs. The wheel base is 6 ft. and the gage is 4 ft. 8½ ins. The axles are of steel, 3½ ins. at center, 4 ins. wheel fit and 3¾ × 7-in. journals. The oil boxes are of cast iron, with lead-lined brass bearing and axle and stops. The drawbar head is of cast iron, with heavy double-coil draw springs and continuous drawbar. The truck frame of the car is oak, as also is the box frame, all being thoroughly bolted and strengthened by a strong truss at each end. The bottom, sides and ends of the box are of oak, 1¾ ins. thick, and the bottom of the box is lined with 3-16-in. steel plate. The box is riveted on three sets of strap hinges, and will tip at an angle of 40°. The door is also hinged on heavy cast iron hinges, with central bolt, and is securely locked shut by means of levers dropping into place by gravity and automatically secured in place by means of a locking lever at the opposite side of the car. This same lever also locks the box in position for loading. The ironwork is all covered with one coat of asphaltum, and all the exposed portions of the woodwork are painted with two coats of best mineral paint.

While the glacial drift excavation was going on, the contractors were busily at work installing a plant suitable for excavating the large amount of rock. At the beginning it was decided to adopt high-power derricks for removing the rock from the pit, the idea being that these machines would not only be efficient for the work in hand, but they they could be used afterwards for quarry work, and therefore stand a good chance of being easily sold. For such a character of excavation as the work on the channel demanded, the derricks were largely experimental, and it was found that many features of construction suitable to a quarry derrick must be modified in order to make them suitable to the canal work. These modifications were not of great difficulty, but they took time, and meanwhile the work fell behind in progress. Indeed, it was not until late in the autumn of 1894 that all the machines were completed in satisfactory working order and the work of removing rock begun at such a rate as to assure the completion of the excavation in a reasonable time. Since that time the contractors have shown some wonderful records of excavation, removing as much as 167,900 cu. yds. of solid rock in place in two months.

Altogether six derricks are used, four of which are self-contained, double-boom, traveling derricks mounted on turntables, and two are double-boom fixed derricks, which work together on opposite sides of the channel. The traveling derricks were designed by Dion Geraldine, of Chicago, Ill., and the fixed derricks by the American Hoist & Derrick Co., of St. Paul, Minn.

Fig. 82 is a view of one of the double-boom traveling derricks. Of the three other traveling derricks, one is the twin of the derrick illustrated, and the other two differ in having one boom of wood and in other details, but are like each other. The derrick illustrated is, however, the latest improved design, and a description of its general construction will answer exactly for its twin, and in a general way for the others. Fig. 83 shows the two wooden boom derricks, of which the one on the left hand was the first one constructed, and was afterward changed so that the center tower rose to a point instead of being truncated. The reason for this change is obvious, and now both are exactly alike, or as shown by the right-hand machine in Fig. 83.

Returning to Fig. 82, it will be seen that the derrick is erected on a platform or frame, which is carried on rollers that travel on temporary timbers or skids laid on the berm. On this frame is a turntable, which carries the main floor or platform of the derrick, to which are attached the superstructure and machinery. The rack of this turntable is 28 ft. in diameter, and by means of it vertical pinions, operated by two 8 × 8-in. vertical engines, revolve the derrick on its axis.

The superstructure of the derrick consists of a pyramidal center tower of timber framework 113 ft. high from apex to track, and of two trussed steel booms 164 ft. and 155 ft. long, respectively. Two fall blocks are hung from each boom, the lines going to the hoisting engines on the platform, and there are also the proper sheaves and connections for raising and lowering the booms. The sketch, Fig. 84, together with Fig. 82, will enable a clear understanding of the arrangement of the fall block ropes and other lines. Take first the fall block ropes. From the engine drums the rope for fall block No. 1 runs up the boom to a, b, c and d, and for fall block No. 2 to e, f, g and h, as shown in Sketch 1. The line for raising and lowering the boom runs up the tower, Sketch 2, to A and thence to B, C, D and E, Sketches 1 and 2. The arrangement of the fall block lines for the opposite boom is just the same as described above, but as a sheave for raising this boom is attached between the two sets of boom sheaves for the two fall blocks, as well as at the tip of the boom, a somewhat different arrangement of the boom lines is necessitated. A glance at the near boom of Fig. 83 will show the difference of arrangement.

The four fall blocks are operated by a four-drum hoisting engine placed on the derrick floor. Fig. 85 is a side elevation of the engine used in the derrick shown in Fig. 82. This machine was built by the Gates Iron Works, of Chicago, Ill., and has done especially satisfactory work. As

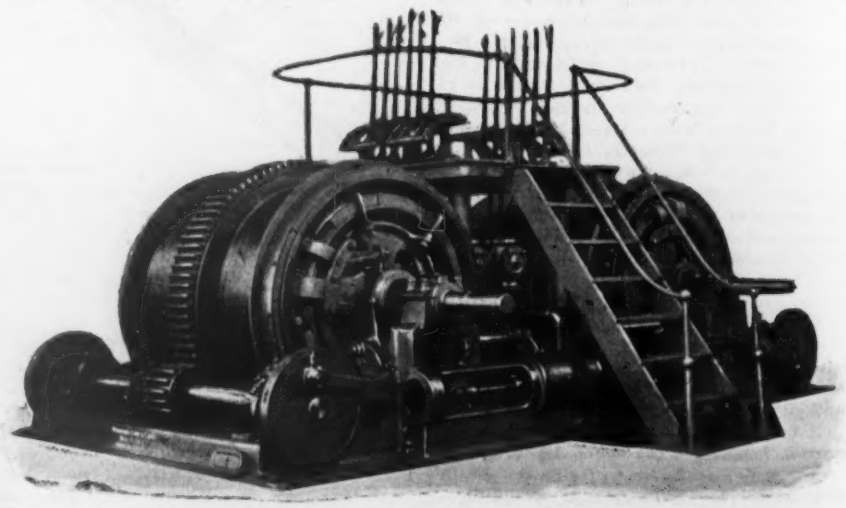


FIG 86. HOISTING ENGINE FOR DOUBLE BOOM TRAVELING DERRICKS SHOWN IN FIG. 83.
Webster, Camp & Lane Machine Co., Akron, O., Builders.

will be seen, the engine has four winding drums, two adjacent to each boom, on each pair of which the ropes from the two skips of each respective boom are wound, the object being to lift both skips on one boom and lower both skips from the end of the other boom simultaneously while the derrick is being revolved. When the proper point for dumping has been reached by the loaded skips, they are automatically dumped, and

the loaded ones are attached to the tackle of the other boom by the workmen in the cut.

The engine rests upon a base, which supports it sufficiently above the floor to allow clearance for the spur wheels on the two lower drum shafts. The engine beds are connected to and mounted upon this base, and in turn support the main side frames in which are journaled the two upper drum shafts, and also support the operating platform, upon which are arranged all the levers for the proper manipulation of the entire derrick.

FIG. 87. DOUBLE BOOM FIXED DERRICKS IN WORKING POSITION, SECTION 14.

Upon the upper and lower drums of each end the lifting ropes from the skips on that side are wound.

The engines are 12 × 16 ins., and make 200 revolutions per minute, and are coupled to the crank shaft at an angle of 90°. Upon the crank shaft are mounted the spur pinions that engage with the main spur wheels on the drum shafts of the front drums—that is, the drum near the crank end of the engine. The rear drums, upper and lower, are driven by means of an intermediate shaft, having pinions engaging with their spur wheels, and also with the pinions on the crank shaft, for the purpose of imparting to the drum the proper direction of rotation. The drum shafts all run continuously, and the power is applied to the drum through the means of the well-known Mundy friction arrangement. At the end of each drum, opposite the spur wheel, is provided an auxiliary dumping drum for the purpose of automatically dumping the load at any given point in the lift, by means of which the dumping point may be instantly varied at the will of the operator. The Gates Iron Works have patented this device. This device is not used on the canal work, as will be described later.

The engines used for the other three derricks were made by the Webster, Camp & Lane Machine Co., Akron, O., and one of them is shown by Fig. 86. They have 11 × 15-in. cylinders and 60-in. drums, and are mounted on a continuous bed-plate. The operating levers, including those for operating the throttle and reverse motion, are grouped on an elevated platform, as shown. The illustration shows this to be in every respect an unusually compact and handsome machine.

The manner of operating all four derricks is the same. While one boom overhangs the channel, the other overhangs the spoil bank, and each boom carries two fall blocks, to which are attached two skips; thus two loaded skips are being attached in the pit, just as the two opposite skips are being dumped. As soon as two skips are attached in the pit, the engineman begins to raise them and swing them around out of the pit and over the spoil bank, and at the same time to lower the skips on the opposite boom, which the turning motion is bringing over the pit. The raising of the loaded skips continues until the button of the hoisting rope actuates the dumping rope, Fig. 85, and empties the skips. Hoisting is then stopped, while the opposite skips, which have reached the pit, are unhooked and loaded skips hooked in their place. This process of hoisting, turning and lowering of the skips is repeated as continuously as the rapidity of loading them will permit.

A face about 12 ft. high and extending diagonally across the channel is worked, and the number of loaders worked on each face, the cost of operating the derrick working that face, the wages paid, cost of coal, etc., are shown in the following table:

No. laborers worked on face	50 to 60
No. foremen worked on face	1
Wages, laborers, per hour	15 cts.
Wages, foremen, per month	$75.00
No. skips worked on face*	12 to 14
Av. skip load, cu. yds.	2
Wages, derrick engineman, per shift	$2.50
Wages, derrick fireman, per shift	1.75
Wages, derrick trackmen (two), per shift	$3.00
Tons coal burned per shift	2
Cost coal per ton on ground	$2.00
Cost oil, water, waste, watchman and superintendence per shift	5.00

With this labor force loading the skips and operating the derricks, the output of each derrick for five months of 1895 was as shown in Table VI. These figures have been calculated from the records of the Division Engineer, Mr. C. L. Harrison, and show the output of rock in place per day worked. Lumping together the work of all four derricks for five months, it was found that the average output of each per 10-hour shift was 300.6 cu. yds., or assuming an average of 56 men to have worked regularly on each face, the output per man per 10-hour shift was 5.36 cu. yds.

Fig. 87 is a view of the two fixed derricks in position for work. As will be seen, they stand on opposite sides of the channel, and are guyed together and to anchors in the ground. As originally constructed, both derricks had double booms, but afterward one boom was removed from the right-hand derrick, making it a single-boom derrick. These derricks were built by the American Hoist & Derrick Co., of St. Paul, Minn.

Both derricks are operated in exactly the same manner, so that the description of the operating machinery for one of them will answer for the other. For this purpose the double-boom derrick, with metal mast and booms, will be taken. Fig. 88 shows this machine very clearly. The mast is 130 ft. high and the booms 120 ft. long, and all are trussed as shown. This superstructure is mounted on a timber platform, which can be skidded along the canal bank on rollers. The power machinery is placed in a house separate from the derrick, but also mounted on rollers. Briefly described, it consists of a four-drum double engine, two drums of which operate the fall block ropes and two the ropes for hoisting and lowering the booms. The same engine operates a winch, from which a rope passes around a disk, or "bull wheel," fastened to the bottom of the mast. By winding the rope on the winch the derrick is revolved on its vertical axis. The method of operating the derrick in removing and dumping the rock is nearly the same as used with the traveling derricks previously described.

* Two of these skips are constantly attached to boom.

TABLE VIII.—Showing for Five Months the Number of Ten-Hour Shifts Worked and the Output per Shift for Each of the Six Derricks Worked on Section 14.

Month.	Traveling derricks. No. 1. No. shifts worked.	No. 1. Cu. yds. per shift.	No. 2. No. shifts worked.	No. 2. Cu. yds. per shift.	No. 3. No. shifts worked.	No. 3. Cu. yds. per shift.	No. 4. No. shifts worked.	No. 4. Cu. yds. per shift.	Fixed Der'ks. Nos. 5 and 6. No. shifts worked.	Nos. 5 and 6. Cu. yds. per shift.
March, 1895	48.2	211.6	30.5	124.6	43.0	280.0	47.8	271.9	71.1	137.8
April, "	50.1	207.4	46.7	235.5	48.6	345.7	47.1	371.5	90.1	150.9
May, "	43.0	344.2	53.1	184.5	50.3	441.3	51.9	405.6	64.3	147.7
June, "	48.1	261.9	33.8	165.7	22.3	322.8	42.9	342.6	77.7	145.4
July, "	49.5	327.3	26.1	256.7	47.4	438.8	48.0	333.3	53.7	210.4
Five months	238.9	288.4	190.2	189.4	211.6	366.9	237.7	344.9	356.9	158.5

Turning now to the general features of the work, it has already been stated that a 12-ft. face extending diagonally across the channel is worked. The length of this face is about 225 ft., and generally from 30 to 33 12-ft. holes, 9 ft. back from the face, are drilled, and the entire face broken down at once blast. Both Ingersoll-Sergeant and Rand drills are used, and four drills are worked on each face. The explosive used is dynamite, 40% glycerine, and it requires about 1 lb. per cu. yd. of rock excavated. Air is supplied by a 20 × 36 × 20¼-in. Corliss duplex Ingersoll-Sergeant compressor, which pumps into 5 × 10-ft. receivers. The compressed-air pipe is 10 ins. in diameter at the receivers and decreases to 4 ins. at the ends. This pipe is shown in the foreground of Fig. 82 with one of the joints for contraction and expansion at the extreme right. The channeling is done by seven Ingersoll-Sergeant channelers.

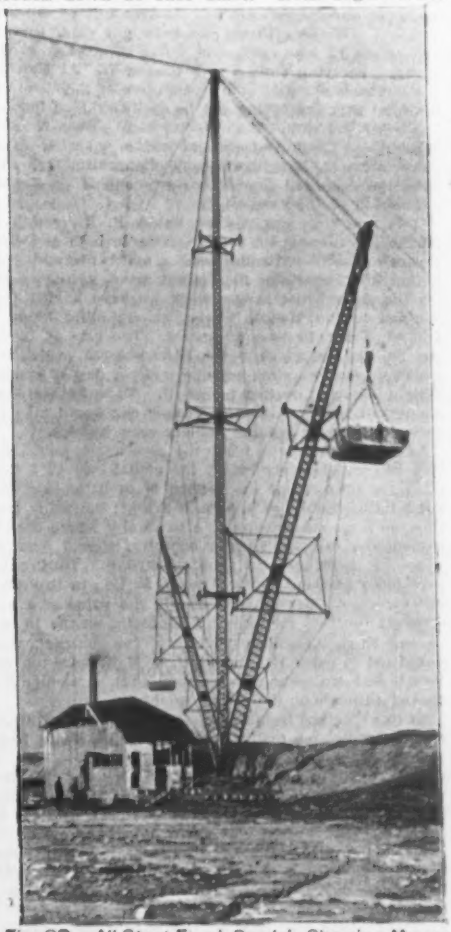


Fig. 88. All Steel Fixed Derrick Showing Manner of Carrying Skip.

FREIGHT AND MAIL TRAFFIC ON STREET RAILWAYS.

On the street railway in which I am interested we have a regularly organized freight department, waybilling merchandise in regular steam railway fashion, and running regularly scheduled freight trains, which pay handsomely. This line grew out of a tumble-down horse railway in Newburg, and after being rebuilt and extended, and equipped electrically, we found ourselves tapping the rich Walkill Valley, at Walden, 12 miles away, and terminating at the front door of one of the largest cutlery works in this country, running by all the stores and shops in town, and giving an opportunity besides to the dairymen of Orange County to get their milk, butter and cheese to boats on the Hudson River at Newburg inside of an hour, when formerly they had carted it the distance over the rough country roads, the teamster spending the best part of the day at it.

This line, because it is a short cut, and because goods can be transported at low rates, is handling the dry goods and other merchandise for Walden merchants, shipped from New York by boat to Newburg; the raw material for the cutlery works, in the way of steel, brass and wood and other supplies, and bringing back manufactured material in cases; hay, straw and fruit, and condensed milk in cans from the Borden condensery, only two miles from our terminus at Walden. The road runs along the highway in some portions, and at other points the line is set back from the roadway on independent property, but we run near to many large farms, and the men on these places hustle their hay and straw in bales out at the side gate to the track, and stop the freight car handily, saving (besides 50 cts. to $1 per ton for freight) a long drive to the steam railway freight station. In August the operating cost for handling our freight was a trifle over 40% of the gross receipts. We ran three motor freight cars, carrying from 8 to 12 tons each, and 4 flat or gondola cars as trailers, carrying from 6 to 8 tons each. At Newburg the line runs alongside the string-piece of the steamboat dock, so that everything can be easily skidded between the boats and cars. We also run close to the Erie and West Shore freight houses and tracks, ensuring an all-the-year-round New York connection, although, as a rule, the Ramsdell line of boats is out of service but one month of the year.

It is said that the Walkill Valley R. R., which we parallel, is running its freight trains in both directions through Walden without stopping, and is discussing the notion of discharging the freight agent at that point. On the other hand, in one week we have hauled from Walden to the Hudson River, among other kinds of freight, about 75 tons of grapes. The rate of 13 cts. per 100 lbs. net to us makes $2.60 per ton, which is a good rate, and requires but one trip per day of a motor freight car and trailer to get it. To earn the same amount of money with a passenger car would take the entire day, and a regular full-day crew besides.

As to mail contracts, while the government compensation is comparatively small, the actual cost to a company for performing the service is so little that they must be profitable, to a certain extent; but aside from this, no large corporation in a large city where the circumstances call for such a contract, should overlook a special safeguard in time of strikes. During my presidency of the Atlantic Ave. R. R. Co., in Brooklyn, our experience proved conclusively the value of a government contract for carrying the mails, as the 19 cars on our Fifth Ave. line, which, by the contract, were permitted to carry the legend U. S. Mail, were not molested, and we were able to keep that particular line opened throughout the whole trouble.

As to collecting freight without interfering with passenger traffic, on roads running cars on short headway probably there would be some trouble, but as we run once an hour between Newburg and Walden, we have ample time, particularly as the line runs through the main street and the stores are all located on that street. It never interferes with the passenger service. We have a general freight house in Walden, with a siding, where freight is delivered during the day. We have our freight trains arranged on a regular schedule, and some of the freight is collected along the line of the road. Of course, a great deal of it is delivered at the freight houses.

Discussion.—Mr. Meiklehan: In 1888 a road in Norristown undertook to do that work, and made a great deal of money out of the freight service, but the trouble came in at the point of delivery. We were expected to take packages to anybody along the line, and its delivery might require skids to get it to the door, and the delay was found to be very annoying. If we could have certain points at which to take up and deliver freight, we could put up sidings and the matter would be simplified.

Mr. Norton.—Most of our freight is sent through from one point to the other, and we have comparatively little intermediate freight in the 12 miles between the two points. Most of the firms who send their freight are within easy reach of the freight houses, so that we have not had any inconvenience in receiving or delivering it. There is no question about the right to carry the U. S. Mail sign on all cars, whether carrying mails or not. We had in Brooklyn two cars arranged like the regular railway mail cars on the long line to Coney Island. We had a side track into the General Post Office in Brooklyn; the mail was put into the cars, and the mail clerks went along and distributed it, and they picked it up and sorted it in the car and delivered it at various stations. The West End Division of the Atlantic Ave. system was formerly a steam road, and they had a regular government contract to carry the mail. When we changed the road over to electricity we carried on the contract.

Mr. McNamara.—We have been operating for over a year a freight line between Albany and Troy, and have a freight house in each place. We do not aim to take up packages on the trip, operating it only as a through freight line.

PEARY'S ARCTIC WORK IN 1895.

Mr. Robert E. Peary, C. E., U. S. N., is on his way home from North Greenland with his party. A brief outline of his last season's work has been given to the press, from which the following abstract is made:—The first obstacle met with was in October, 1894, when it was discovered that the usual snows of September had buried beyond recovery the food caches on the ice-cap. Mr. Peary himself spent two days in an exhaustive search for the caches, but had to give it up. By this misadventure all his biscuit, milk and pea soup, and all of his pemmican and alcohol, two fundamental items of Arctic sledge rations, were lost. But he replanned his campaign with raw deer meat for his men and walrus oil for the dogs, and coal oil used as a substitute for alcohol. He had only 130 lbs. of biscuit in tins, and eked out this supply with bulky ship-biscuits.

On April 1, he left for the ice-cap, with Lee and Henson, 6 Eskimos and 63 dogs. The Eskimos only accompanied them for the first 124 miles. They at last found one cache and completed their supply of sealed tins of biscuit and obtained the milk ration required. About March 9 they were 200 miles on their journey and 7,000 ft. above the sea, with the day temperature ranging from 10° to 25°, and from 25° to 43° at night. The dogs soon began to give out under low rations of raw, frozen meat, and after making 400 miles, the largest sledge went to pieces beyond repair; the last of the walrus meat was also fed to the dogs, of which only 17 now remained alive. At the end of a week after that only 11 dogs were left, and Peary, Lee and Henson had to man the drag-ropes themselves.

They then cached nearly everything and pushed for the land at the foot of the ice-cap; but they were compelled to leave the last of the dogs in charge of Lee 16 miles from the land and 5,000 ft. above the sea. Peary and Henson, with four days' rations, went forward in search of musk oxen; but, after being storm-stayed for 2½ days, were compelled to return without fresh food for the men and dogs. They took the desperate chance of pushing on with what they had left towards the land, and after some days killed six musk oxen and calves, all that they succeeded in finding. After some days more spent in skirting the shore of Independence Bay, over sharp stones that speedily destroyed their sledges and compelled the party to carry their own stores, the return journey was commenced from their last cache, 35 miles inland. The start was made with nine dogs and 16 days' rations of meat for them, and 17 days' rations of raw venison for the party. Fortunately the weather was favorable, and the home camp was reached on June 25 in 25 marches. Only one dog reached the camp, and the last provisions were consumed 21 miles from the lodge, or journey's end.

Thus, owing to the loss of their foodcaches and the consequent weakness of the party, Mr. Peary failed to make any pronounced advance northward in their summer trip. But much intervening time was usefully spent by Mr. Peary and by Messrs. Diebitsh, Salisbury, Dyche, Le Boutillier and Walsh in surveying many miles of unknown coasts, in taking thousands of photographs, and in securing a large collection of deer, walrus and Northern animals, and birds, flowers and lichens. They also obtained two meteorites, the largest weighing three tons. The mapping of the Whale Sound region was completed, another year's meteorological records were obtained, and the study of the Arctic Highlander, together with the ethnological collection made, about completes the record of the most northerly inhabitants of our globe. The past season was not a severe one, and but for the loss of his provisions, Mr. Peary says, he would have accomplished his purpose.

Mr. Peary left on his second Arctic expedition on July 15, 1893, and he remained in Greenland through last year preparing for this season's advance to the North.

An express locomotive with a single pair of 7-ft. driving wheels, a four-wheel leading truck, and a single pair of trailing wheels is being built by the Baldwin Locomotive Works, to haul the mail trains from Chicago to Galesburg, 168 miles, on the Chicago, Burlington & Quincy R. R. It will closely resemble the engine illustrated in our issue of Aug. 29, but will be simple instead of compound.

The efficiency of various patented processes of water purification is to be tested by the Louisville Water Co. Contracts have been made with several filter companies, and the Jewell Filter Co. has already erected a 250,000-gallon plant at Louisville, and the Cumberland Manufacturing Co., which makes the Warren filter, has a plant of the same size nearly completed. The tests will run through a number of months. Mr. Geo. W. Fuller has recently resigned his position as Biologist-in-Charge of the Lawrence Experiment Station of the Massachusetts State Board of Health to accept that of Chief Chemist and Bacteriologist of the Louisville Water Co. Mr. Chas. Hermany, M. Am. Soc. C. E., is engineer of the company, and the tests will probably be carried out under the joint direction of Mr. Hermany and Mr. Fuller, although from the nature of the tests, most of the responsibility will doubtless fall upon the latter after the work is fully started.

Good progress is being made in rebuilding and cleaning out the Toronto water intake. This intake rose to the surface and broke at two or three points early in the present month, as noted last week. Mr. C. H. Rust, Deputy City Engineer, informs us that the chief difficulty encountered is in removing the accumulation of sand from the intake. The old wooden conduit across the island, which lies between the bay and the lake, he states, has about 2 ft. of sand in it, but it is expected that lake water will again be pumped about the last of this month. Meanwhile, Mr. Rust writes, all the watering carts of the city and 16 borrowed from Hamilton are distributing drinking water from the adjoining municipalities, most of which is brought in on the electric roads in the trolley sprinklers. From these sprinking cars a fire engine fills the street watering carts. Mr. Jas. Mansergh, M. Inst. C. E., of London, has been engaged at a fee of $15,000 to report fully on the Toronto water supply. It is expected that he will reach New York on Sept. 28, and that he will spend about two weeks in Toronto.

The storage battery cars which are to be tried on the Second and Fourth Ave. railways, in New York city, are to be equipped with chloride batteries, which will be placed under the car, and so located that the shifting of batteries can be done expeditiously. The installation is being made by the Electric Storage Battery Co., of Philadelphia, which now controls the important United States patents on storage batteries. It is hoped to reduce the cost of handling and maintaining the batteries in service to 3 cts. per car-mile, and to save this amount through various economies peculiar to the storage battery system. Thus the power-generating plant need be only two-thirds as large, and owing to its steady load, can be run with higher economy. The low-pressure current used greatly increases the durability of the motors. There is also a gain in the durability of the machinery in the central station. Where it is a question of the storage battery or a conduit system, the heavy first cost of the latter ought to give the storage battery a good chance to make the best record, if only a reasonable durability can be secured for the battery plates.

Surveys for the park system of Essex County, N. J., have been started on a tract of 60 acres donated by the city of Newark. Mr. Cyrus Peck is President, and Mr. Alonzo Church is Secretary of the Essex County Park Commission, and Messrs. John Bogart, M. Am. Soc. C. E., and N. F. Barrett are at the head of the department of landscape architecture and civil engineering. The office of the commission is at 800 Broad St., Newark. The sum of $2,500,000 is at the disposal of the commission for use at its discretion in acquiring and improving land for park purposes within the county.

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PERSONALS.

Mr. J. C. Parker, Superintendent of the Detroit Dry-Dock Co. for many years, died at Detroit, Mich., Sept. 18.

Mr. A. G. Riter has been appointed Engineer of Bridges of the city of Chicago, succeeding Mr. W. R. Roberts.

Dr. John S. Young, formerly Deputy Health Commissioner, of Brooklyn, N. Y., died in that city Sept. 24, at the age of 63.

Mr. Joseph O. Wilson, of Topeka, Kan., one of the receivers of the Atchison, Topeka & Santa Fe R. R. Co., died in New York Sept. 18 at the age of 58.

Mr. P. I. Welles has been appointed Superintendent of the Third Division of the Southern Ry., with office at Columbia, S. C., succeeding Mr. E. Berkeley, who has resigned.

Mr. Hugh N. Camp, of the firm of H. N. Camp & Sons, dealers in cement, died recently at his home at Morris Heights, N. Y. He was born in 1827, in Livingston, N. J.

Prof. Elmore D. Cummings has been appointed Assistant Professor of Civil Engineering in the Maine State College, at Orono, Me. He graduated at Cornell University in 1889.

Mr. Alfred F. Harley has been elected City Engineer of Jacksonville, Fla. He held the position for three years previous to June, 1894, when he was succeeded by Mr. Lewis Mattair.

Mr. Philip Prioleau has been appointed First Assistant City Engineer of Jacksonville, Fla. He has been Acting City Engineer since the accession of the present Board of Public Works.

Messrs. Albert D. Holmes, D. Webster Pettee and Oliver H. Green have been elected water commissioners of Sharon, Mass., for terms of one, two and three years, respectively.

Mr. Thomas Walsh, contractor, of Brooklyn, N. Y., died Sept. 16. He had been engaged on the timber dry-dock at the Brooklyn navy yard and on the removal of the McComb's Dam bridge, New York city.

Mr. W. T. Reed, Superintendent of Motive Power and Machinery of the Seaboard Air Line, has moved his headquarters from Raleigh, N. C., to Portsmouth, Va., where the general offices of the company are now located.

Mr. George H. R. Preble, of Boston, Mass., has been elected Superintendent of the Fitchburg & Leominster Street Ry., with office at Fitchburg, Mass. He was Superintendent of Construction for the Tacoma Street Ry., at Tacoma, Wash., for two years.

Mr. J. Kruttschnitt, General Manager of the Atlantic System of the Southern Pacific Ry., has been elected Second Vice-President of the Southern Pacific Ry. Co., succeeding the late Mr. A. N. Towne. He will retain his present position as General Manager.

Mr. William S. Johnson, Sanitary Engineer of the Health Department of Brooklyn, N. Y., has resigned his position and gone to Boston to accept a position as Assistant State Sanitary Engineer. Mr. W. W. Locke, Assistant Sanitary Engineer, will succeed Mr. Johnson.

Mr. Allen W. Dale, a clerk in the Civil Engineering Department of the Pennsylvania R. R., with headquarters at Reading, Pa., was killed at Trenton, N. J., last week, his body being found in the Raritan Canal. He was 62 years of age, and a graduate of Princeton College.

Maj. Henry M. Adams, U. S. Engrs., has been ordered to relieve Lieut. Wm. E. Craighill as Engineer of the Third Lighthouse District, and Capt. Wm. H. Bixby to relieve Maj. Charles W. Raymond as Engineer of the Fourth Lighthouse District, upon the expiration of his sick leave.

Col. W. M. Patton has been appointed Professor of Civil Engineering at the Virginia Agricultural & Mechanical College, Blacksburg, Va. He had charge of the building of the Susquehanna River bridge on the B. & O. R. R., and of several other difficult pieces of work. He is the author of a work on "Foundations" and of a treatise on "Civil Engineering," recently published.

Mr. Joshua W. Woolston, President of the Nesquehoning Valley R. R., which is leased to the Central Railroad of New Jersey, died Sept. 14 at his home in Germantown, Philadelphia, aged 74 years. He was interested in a large number of coal and railway corporations, and was for many years Treasurer, and afterward President, of the Delaware Division Canal Co. He was also a director of the Nesquehoning Valley R. R., and became its President upon the death of Mr. J. B. Moorhead, in October, 1889.

Mr. James O'Keefe, railway contractor, died at Poteau, Ind. Ter., Sept. 10, at the age of 53. He was born in Boston, Mass., and some years ago went to Nebraska with his father, who was a railway contractor, and engaged in the construction of the Chicago, Burlington & Quincy R. R. line through Iowa. He was Superintendent of Construction with Fitzgerald, Mallory, Cushing & Co., and at the time of his death was engaged with his brother, John O'Keefe, in building a part of the Kansas City, Pittsburg & Gulf R. R.

Mr. George W. Fuller has resigned his position as Biologist-in-Chief of the Lawrence Experiment Station of the Massachusetts State Board of Health to accept the position of Chief Chemist and Bacteriologist to the Louisville Water Co., of Louisville, Ky. In the latter capacity Mr. Fuller will be connected with some extended water purification tests, as noted elsewhere in this issue. Mr. Fuller is a graduate from the Massachusetts Institute of Technology, and has spent some time abroad in scientific study. He secured a thorough chemical training before taking up biological work, and has been connected with the Lawrence researches for many years, first as biologist, when Mr. Allen Hazen was Chemist-in-Charge, and since Mr. Hazen's resignation, in 1893, as Biologist-in-Charge of the station.

Mr. Cary A. Wilson, of Parsons, Kan., Chief Engineer of the Missouri, Kansas & Texas Ry., died suddenly Sept. 14 in New York city, where he had gone for a brief period of rest, having been in ill health for some time. He was born in Newark, O., about 50 years ago. He served in the Civil War, attaining the rank of captain, and being for a time imprisoned at Andersonville. His engineering work was begun on the construction of the Toledo & Ohio Central R. R., and later he was Principal Assistant Engineer on the New York, Chicago & St. Louis R. R., having charge of the construction of the line from Cleveland to Chicago. His next engagement was as Chief Engineer of the construction of the Buffalo, Rochester & Pittsburg R. R. from Buffalo to Punxsutawney, Pa. For about eight years after this he was mainly occupied in the survey and construction of branch lines for the East Tennessee, Virginia & Georgia R. R., and he surveyed a line through Arkansas, to connect Memphis and Kansas City. In 1887 he was Chief Engineer of the Mobile & Birmingham Ry., and in 1888 became Chief Engineer of the East Tennessee, Virginia & Georgia R. R. In 1892 he was appointed Chief Engineer of the Missouri, Kansas & Texas Ry., and has since been busily engaged in the construction of numerous branch lines for that system.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
Sept. 28. Secy., C. C. Brown, City Engineer.
COLUMBIAN ENGINEERING SOCIETY.
Oct. 1. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.
WESTERN SOCIETY OF ENGINEERS.
Oct. 2. Secy., Chas. J. Bonev, 1736 Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 2. "Moving Two 36-in. Water Mains Without Shutting Off the Water," by E. C. Moore. Secy., C. W. Hunt, 127 E. 23d St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Oct. 2. "The Continuous Rail in Street Railway Service," by Richard McCulloch. Secy., W. H. Bryan, Turner Blk.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 4. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
ENGINEERING CLUB OF COLUMBUS, O.
Oct. 5. Secy., David Buell.
ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 5. Secy., L. F. Rondinella, 1122 Girard St.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 8. At Atlanta, Ga. Secy., R. W. Raymond, New York, N. Y.
ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 8. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 8. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 8. Secy., H. Breen, 36 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Oct. 8. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Oct. 8. Secy., D. W. McMorris, Burke Bldg., Seattle, Wash.
WISCONSIN POLYTECHNIC SOCIETY.
Oct. 8. Secy., W. K. Means, Loan & Trust Bldg., Milwaukee.
NEW ENGLAND RAILROAD CLUB.
Oct. 9. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 10. Secy., C. H. McLeod, Montreal.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 10. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Oct. 10. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Oct. 10. Secy., Jas. K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 10. Secy., H. D. Ruhm, Nashville, Tenn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Oct. 12. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
Oct. 14. Secy., F. W. Tuttle, Baird Building.
AM. SOCIETY OF RAILROAD SUPERINTENDENTS.
Oct. 14. Annual meeting at New York. Secy., C. A. Hammond, 143 Liberty St., New York.
AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Secy., John N. Partridge, Brooklyn, N. Y.
AMERICAN INSTITUTE OF ARCHITECTS.
Oct. 15, 16, 17. Annual convention, at St. Louis, Mo. Secy., Alfred Stone, Providence, R. I.
WESTERN RAILWAY CLUB.
Oct. 15. Secy., W. D. Crosman, Rookery Bldg., Chicago.
AMERICAN RAILWAY ASSOCIATION.
Oct. 16. At New York. Secy., W. F. Allen, 24 Park Place, New York.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 16. Secy., F. Van Vleck, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 16. Secy., S. E. Tinkham, City Hall, Room 36, Bromfield St.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Oct. 16. Secy., J. A. Pilcher, Roanoke, Va.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Oct. 16. Secy., R. W. Pope, 26 Cortlandt St., New York.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 17. Secy., D. Carhart, Carnegie Library Bldg., Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 17. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Oct. 17. Secy., John A. Hill, 256 Broadway, N. Y.
ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 21. Secy., E. Nexson, Kasota Block.
CENTRAL RAILWAY CLUB.
Nov. 8. Secy., H. D. Vought, Buffalo "Courier," Buffalo, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 21. Secy., C. A. Charpiot, Macon, Ga.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.

MICHIGAN ENGINEERING SOCIETY.—The ballot for officers has resulted as follows: President, George L. Wells, St. Louis; Vice-President, Frank T. Rogers, Port Huron; Secretary, Francis Hodgman, Climax; Directors, Dorr Skeels, Grand Rapids; W. B. Sears, Saginaw, and William Appleton, Lansing.

WESTERN SOCIETY OF ENGINEERS.—The regular meeting of the society for the reading of papers was held at the Armour Institute, Sept. 24. Mr. Ambrose V. Powell read a paper entitled "Some Notes on the Dry-Docks of the Great Lakes," making especial reference to the new dry-dock of the Chicago Shipbuilding Co., described in Engineering News, July 25, 1895. The paper was discussed briefly by several of the members.

ROADMASTERS' ASSOCIATION OF AMERICA.—The 13th annual convention of the association will begin Tuesday, Oct. 8, at 10:30 a. m., at the Southern Hotel, St. Louis, Mo. The following is a partial list of the committee reports and papers which will come before the convention: Committee Reports, "Joint Fastenings," "Advisability of Increasing Rail Lengths and Using Miter Joints," "Hollow Tires and Injury Caused to Split Switches by Their Use," "Preservation of Ties," "Track Records," "Standard Track Tools." Papers: "Methods for Providing Expansion in Long Connecting Rods to Derails and Split Switches," by J. A. Kerwin; "The Relative Gage of Car Wheels and Track and the Flangeway of Guard Rails," by C. E. Jones." The rates at the Southern Hotel will be $3 per day, and both the Wagner and Pullman palace car companies will give half-fare rates.

NATIONAL IRRIGATION CONGRESS.—The fourth national irrigation congress was held at Albuquerque, N. M., last week. Mr. Wm. E. Smythe, Chairman of the National Executive Committee, detailed the progress of irrigation during the past year. Since the passage, in August, 1894, of the Congressional act providing for the cession of 1,000,000 acres of government land, under certain conditions, to each state in the arid region, Wyoming, Colorado, Idaho, Montana, Washington, and Nevada have passed the necessary legislation to accept the grant, but Nevada has not provided funds and administrative machinery for the purpose. A year ago only Colorado, Wyoming, and South Dakota, of the Western states, had state engineers, but since that time Kansas, Nebraska, Texas, Idaho, Montana and Washington have established engineering departments. A number of papers were read during the congress, and a lengthy address to the American people was reported by the committee on resolutions. The next place of meeting will be Phoenix, Ariz. Mr. E. B. Moses, of Kansas, was elected as chairman of the national committee.

AMERICAN STREET RAILWAY ASSOCIATION.—The 14th annual meeting will be held in the Windsor Hall, Montreal, commencing at 10 a. m. on Oct. 15, and continuing four days. Special committees will report on the following subjects: "Transfers," "Mu-

nicipal Ordinances," "Labor Question—Wages Paid to Employees," "Experience of Roads in Furnishing Free Music and other Entertainments to the Public," and "Physical Operation of Roads." The executive committee has secured the Victoria Rink for the exhibition of supplies of every nature used in the street railway business. The building has been engaged for two weeks, from Oct. 9 to Oct. 22, giving ample time for the setting up and removal of the largest exhibits. The hall for the meeting is adjacent to the exhibition building, and delegates will, therefore, be enabled to examine the exhibits to the best advantage, and with the least possible loss of time. The exposition will be in charge of Mr. Stonewall Jackson, 27 St. Sacrament St., Montreal. The traffic associations have authorized the sale of tickets at reduced rates—namely, a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. On Oct. 17 there will be the annual dinner. The headquarters of the association will be at the Windsor Hotel. This association has a membership composed of representatives of 175 companies in 124 cities. John N. Partridge, Secy. pro tem, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.—The 13th annual meeting was held at the Y. M. C. A. Building, Albany, N. Y., Sept. 17, with the President, Mr. G. Tracy Rogers, of Binghamton, N. Y., in the chair. The President in his address referred to the growth of electric traction, and stated that as yet no other motive power has been able to compete successfully with electricity. The street railways of New York state aggregate about 1,400 miles, with an investment of $200,000,000, annual gross receipts of $25,000,000, and a traffic of 500,000,000 passengers per year. Over-capitalization is gradually disappearing, owing to the foreclosure of mortgages and a general tendency to conservatism on the part of investors. He considered the present demand to be for a lighter electric motor and a flexible suspension of the motor, to avoid pounding at the rail joints. The report of the executive committee showed that there is now a membership representing 39 companies, being the largest number since the association was founded. The report of the Treasurer showed the financial condition to be as follows: Receipts, $7,286; expenses, $6,299; balance, $987.

The first paper presented was entitled, "Are We Laying Too Many Miles of Track to Reach a Few People?" by Mr. W. W. Cole, of Elmira, N. Y. He pointed out that in general the safer plan, financially, is to keep within the lines of existing population, rather than to extend beyond such lines, in order to build up outlying districts. While real-estate interests may profit thereby, the road has to be operated under conditions which usually involves poor track, poor roads and great wear upon the track and rolling stock. If the end of the line is one block from the dividing line between the settled district and the open country, the people will walk that distance to the cars, thus saving to the company the operation and maintenance of 1,500 ft. of track, which for one year, at 15 minutes headway, and 9 cts. per car-mile, means 5% interest on $26,864, or $3.68 per day. If it becomes necessary to extend beyond the populated limits, all the energy should be devoted to one line, and not spread out over a number of extensions.

The next paper was on "The Economical Equipment and Operation of a Power-House," by Mr. H. S. Newton, of Syracuse, N. Y., and of this we give an abstract in another column. The third paper, "Is a Freight or Mail Service Profitable or Unprofitable?" by Mr. Benjamin Norton, President of the Newburg Electric Ry., of Newburg, N. Y., was in favor of such service, and instanced the case of this road, which is similar to that of other roads described in our issue of July 11, 1895. An abstract of this paper is given in another column.

The next papers were on "Car Heating by Electricity," by Mr. J. F. McElroy, of Albany, N. Y., and "General Track Construction," by Mr. C. Loomis Allen, of Syracuse, N. Y. An abstract of the latter is given on our reading pages, and we shall give an abstract of the former in another issue. The last paper was one on "Signals on Electric Railways," by Mr. J. H. Barnard, of New York. He strongly advocated the use of telephone lines between the turnouts of a single-track road and the central station, so that the Superintendent can communicate with track foremen, conductors, wrecking gangs, etc., while conductors can communicate with each other, so that if a car is so late at a turnout that it has lost its right of way, its conductor can call the conductor of the opposing car waiting at the next turnout and tell him to come ahead.

The following officers were elected for the ensuing year: President, G. Tracy Rogers, Binghamton; First Vice-President, W. W. Cole, Elmira; Second Vice-President, John H. Moffitt, Syracuse; Secretary and Treasurer, Benjamin Frick, Brooklyn; Executive Committee, H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo.

The next meeting will be held in Binghamton on the second Tuesday in September, 1896.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting of Sept. 18, Past President Wm. Worthen in the chair, Mr. John D. Van Buren read a paper on "Notes on High Masonry Dams," of which an abstract was given in our issue of Sept. 12 and in which he advocated a triangular section, taking into consideration a water pressure on the base under full head.

In the discussion Mr. Edward Wegmann said that out of 55 high masonry dams only 3 have failed (the Fuentes, Habra and Bouzey dams), and in each case the failure is ascribed to faulty execution of the work, and not to faulty design. In the construction of the Fuentes dam a pocket of bad material was met with in the foundations, but instead of carrying the work down to solid rock, piling and a grillage were used. For several years the reservoir was not filled to its full height, but when it was filled the pile foundation was crushed down, and the dam gave way, causing the loss of 600 lives. The Habra dam was like a gigantic filter at first, so great was the leakage, but it gradually silted up and stood for eight years, when a flood came, which raised the water so that it flowed over the dam, being 13 ft. deep on the crest, and this great pressure caused the crushing and overturning of the dam. The only case in which actual sliding of the dam has occurred is that of the Bouzey dam, the construction of which was defective in many ways (Eng. News, May 23, 1895). As to Mr. Van Buren's statements, that masonry dams could not be made watertight, he said that the Sodom and Titicus dams are both tight, showing very little moisture on the face, and though the former has several springs in the foundation, these have been successfully sealed. As to the upward pressure exerted by water in the body of a dam, he did not think that water passing in a capillary state through solid masonry could be considered as exerting full hydrostatic pressure. There may be some extreme cases where such a section as proposed by Mr. Van Buren may be advisable, but it cannot be accepted as a general or typical section. Mr. Ridgeway said that in the corner of the Titicus dam, where cracks might be expected to occur, if at all, a well 5 × 8 ft. was left in the masonry, but as only hair cracks had developed when the masonry had been carried up 100 ft., the well was filled in and arched over, and the full section carried on above it. Mr. Worthen referred to the construction of numerous low masonry dams built by him, which, he said, were not in the habit of going out.

Mr. Lindenthal, after referring to the necessity of taking earthquakes into consideration, suggested that heavy iron vertical rods connected by horizontal members should be built into and anchored into the masonry, forming a great net, so that the dam could not fall, except by giving out bodily. Mr. Skinner described a singular dam now being built in California, in which a thin core is being used, so thin that the thickness of the plates is designated by the Birmingham wire gage. This sheet iron wall is coated with asphalt, and its ends are cemented into narrow slots cut in the rocky walls of the valley. On each side of the iron wall is a 24-in. wall of concrete, outside of which again is a very large wall of dry masonry or riprap. Mr. Van Buren suggested that the best section to resist overturning would have a vertical rear wall and a long flat slope for the upstream face, horizontal conical wells being formed in the masonry to reduce the amount of material required. He said his section was not a radical departure, instancing the Gileppe (Belgium), Vyrnwy (England), and San Mateo (United States) dams, though the two former are in reversed position, with the steeper face on the upstream instead of the downstream side. The second, however, is designed for an overflow dam. Mr. Parker, in a writen discussion, referred to the fact that the question of cost must be considered, and that the engineer's problem is to combine strength and safety with economy. The general opinion expressed in the oral discussion appeared to be that the assumption of an upward base pressure equal to the full head of water in the reservoir was not warranted, and that the proposed section could only be considered as applicable upder special conditions.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Sept. 27.	Barges.	Louisville, Ky.	Sept. 5
Sept. 27.	Museum building,	Milwaukee, Wis.	Sept. 12
Sept. 27.	Public building,	Allegheny, Pa.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Sept. 27.	Water-wks. system,	Cold Spring, N. Y.	Sept. 12
	Advertised, Eng. News, Sept. 12 and 19.		
Sept. 27.	Water-works system,	Kentland, Ind.	Sept. 19
Sept. 27.	Elec. lighting plant,	Grand Island, Neb.	Sept. 19
Sept. 27.	Pipe sewer, etc.,	Rochester, N. Y.	Sept. 19
Sept. 27.	Driveway in Medford,	Mass.	Sept. 19
Sept. 27.	Macadam road,	Plainfield, Conn.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Sept. 27.	Iron bridge,	Carthage, Mo.	Sept. 19
Sept. 27.	Water-works system,	Ripley, N. Y.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Sept. 27.	Granite block paving,	Brooklyn, N. Y.	Sept. 19
Sept. 27.	Trunk sewer (brick),	Kingston, N. Y.	Sept. 19
	Advertised, Eng. News, Sept. 19 and 26.		
Sept. 27.	Paving,	Pittsburg, Pa.	Sept. 26
Sept. 27.	Pipe sewers,	Pittsburg, Pa.	Sept. 26
Sept. 28.	Water-wks. system,	Ephrata, Pa.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Sept. 28.	Cement,	Washington, D. C.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Sept 28.	Electric lighting,	Homestead, Pa.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Sept. 28.	Macadam road,	Vernon, Conn.	Sept. 19
Sept. 28.	Melan arch bridge,	Ridgewood, N. J.	Sept. 19
Sept. 28.	Rock crushing plant,	San Francisco.	Sept. 19
Sept. 28.	Sewers,	Washington, D. C.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Sept. 28.	Pipe sewers,	Indianapolis, Ind.	Sept. 26
Sept. 28.	Renewing water main,	Pittsburg, Pa.	Sept. 26
Sept. 28.	Macadam road,	Middletown, Conn.	Sept. 26
Sept. 30.	Water-works system,	Bond Hill, O.	Sept. 5
	Advertised, Eng. News, Sept. 5 and 12.		
Sept. 30.	School building,	Mark Center, O.	Sept. 12
Sept. 30.	Iron bridges (2),	Pottsville, Pa.	Sept. 12
Sept. 30.	Light station at	Cedar Point, Md.	Sept. 19
Sept. 30.	Belgian block paving,	Brooklyn, N. Y.	Sept. 19
Sept. 30.	Sewage disposal beds,	Plainfield, N. J.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Sept. 30.	Water bonds ($300,000),	Syracuse, N. Y.	Sept. 19
Sept. 30.	Hospital, etc.,	Newport, R. I.	Sept. 19
Sept. 30.	Telegraph wire (60 miles),	Buffalo.	Sept. 26
Sept. 30.	Water-works,	Chenoa, Ill.	Sept. 26
Sept. 30.	Paving,	Baltimore, Md.	Sept. 26
Sept. 30.	Asphalt paving,	New York, N. Y.	Sept. 26
Sept. 30.	Brick sewer,	Syracuse, N. Y.	Sept. 26
Sept. 30.	Sewer,	Toledo, O.	Sept. 26
Sept. 30.	Heating & ventilating,	Brooklyn, N. Y.	Sept. 26
Sept. 30.	Court house work,	New York, N. Y.	Sept. 26
Sept. 30.	Court house,	Paris, Tenn.	Sept. 26
Sept. 30.	Fire engine houses (2),	Pittsburg, Pa.	Sept. 26
Sept. 30.	Fire engine house,	Binghamton, N. Y.	Sept. 26
Sept. 30.	Plumbing,	Providence, R. I.	Sept. 26
Sept. 30.	Grading,	Syracuse, N. Y.	Sept. 26
Sept. 30.	Iron bridges (2),	Pottsville, Pa.	Sept. 26
Oct. 1.	Plans for art building,	Philadelphia, Pa.	May 23
	Advertised, Eng. News, May 23 to June 27.		
Oct. 1.	Composite gunboats,	Washington, D. C.	Aug. 1
Oct. 1.	Pipe sewers,	Appleton, Wis.	Sept. 19
Oct. 1.	Water-works system,	Laurens, N. Y.	Sept. 19
	Advertised, Eng. News, Sept. 19 and 26.		
Oct. 1.	Supplies for Mare Island navy yard.		Sept. 19
Oct. 1.	Pipe sewers,	Pontiac, Mich.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Oct. 1.	Bridge substructure,	Marinette, Wis.	Sept. 19
Oct. 1.	Water-wks. system,	Mt. Sterling, O.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Oct. 1.	Dredging canal,	Port Huron, Mich.	Sept. 12
	Advertised, Eng. News, Sept. 12 and 19.		
Oct. 1.	State capitol work,	Denver, Colo.	Sept. 12
Oct. 1.	Court house,	Knoxville, Ia.	Sept. 12
Oct. 1.	Electric light plant,	Mt. Sterling, O.	Sept. 12
	Advertised, Eng. News, Sept. 12.		
Oct. 1.	Fire engine, etc.,	Elizabeth, N. J.	Sept. 26
Oct. 1.	Stand-pipe extension,	Jersey City, N. J.	Sept. 26
Oct. 1.	Pumping engine,	La Porte, Ind.	Sept. 26
Oct. 1.	Brick paving,	Trenton, N. J.	Sept. 26
Oct. 1.	Macadamizing,	Depew, N. Y.	Sept. 26
	Advertised, Eng. News, Sept. 26.		
Oct. 1.	Granite block paving,	Brooklyn, N. Y.	Sept. 26
Oct. 1.	Macadamizing,	Ellington, Conn.	Sept. 26
Oct. 1.	Outlet Sewer,	New Brighton, N. Y.	Sept. 26
Oct. 1.	Sewers,	Trenton, N. J.	Sept. 26
Oct. 1.	Heating, ventilating, etc.,	Brooklyn, N. Y.	Sept. 26
Oct. 1.	Additions to city hall,	Brooklyn, N. Y.	Sept. 26
Oct. 1.	School buildings, etc.,	Brooklyn, N. Y.	Sept. 26
Oct. 1.	Jail,	Athens, Ga.	Sept. 26
Oct. 1.	Power plant,	Baltimore, Md.	Sept. 26
Oct. 1.	Almshouse additions,	Elizabeth, N. J.	Sept. 26
Oct. 1.	Grading,	Norfolk, Mass.	Sept. 26
Oct. 2.	Water-works system,	Rockford, Mich.	Sept. 26
	Advertised, Eng. News, Sept. 26.		
Oct. 2.	Paving,	New York, N. Y.	Sept. 26
Oct. 2.	Asphalt paving,	Brooklyn, N. Y.	Sept. 26
Oct. 2.	Macadamizing,	Stafford Springs, Conn.	Sept. 26
Oct. 2.	Sewers,	New York, N. Y.	Sept. 26
Oct. 2.	Fog signal,	Portland, Ore.	Sept. 26
Oct. 2.	Paving,	Boone, Ia.	Sept. 26
Oct. 2.	Court house,	Columbus, Ga.	Sept. 5
Oct. 2.	Pig lead (100 tons),	Buffalo, N. Y.	Sept. 19
Oct. 2.	Sewers,	Buffalo, N. Y.	Sept. 19
Oct. 3.	Bridge abutments,	Franklin, Pa.	Sept. 19
Oct. 3.	Drawbridge,	Bridgeton, N. J.	Sept. 19
Oct. 3.	Water bonds,	Allegheny, Pa.	Sept. 26
Oct. 3.	Cobblestone paving,	Brooklyn, N. Y.	Sept. 26
Oct. 3.	Macadamizing,	Enfield, Conn.	Sept. 26
Oct. 3.	Macadamizing,	Plymouth, Conn.	Sept. 26
Oct. 4.	Bridge superstructure,	Franklin, Pa.	Sept. 19
Oct. 4.	Water-works system,	Peotone, Ill.	Sept. 19
Oct. 4.	Macadamizing,	Stapleton, N. Y.	Sept. 19
Oct. 4.	Highway bridge,	Stapleton, N. Y.	Sept. 19
	Advertised, Eng. News, Sept. 19 and 26.		
Oct. 4.	Pipe sewers (4,800 ft.),	McKees Rocks, Pa.	Sept. 19
	Advertised, Eng. News, Sept. 19 and 26.		
Oct. 4.	Brick sewers,	McKees Rocks, Pa.	Sept. 19
	Advertised, Eng. News, Sept. 19 and 26.		
Oct. 4.	Canal improvements,	Albany, N. Y.	Sept. 26
Oct. 4.	Pig lead,	Baltimore, Md.	Sept. 26
Oct. 4.	Removal of wreck,	Philadelphia, Pa.	Sept. 26
Oct. 4.	Repaving two streets,	Buffalo, N. Y.	Sept. 26
Oct. 4.	Bridge superstructure,	Fairport, N. Y.	Sept. 26
Oct. 5.	Stone road,	Farmington, Conn.	Sept. 26
Oct. 5.	School building,	Norwood, O.	Sept. 12
Oct. 5.	Reservoir,	Oberlin, O.	Sept. 19
	Advertised, Eng. News, Sept. 19.		
Oct. 5.	Macadam road,	East Hartford, Conn.	Sept. 26
Oct. 5.	Portable water tower,	Cincinnati.	Sept. 26
Oct. 5.	Sewer,	Sandusky, O.	Sept. 26
Oct. 5.	Asphalt paving,	Indianapolis, Ind.	Sept. 26
Oct. 7.	Macadamizing,	Van Wert, O.	Sept. 19
Oct. 7.	Bridges (2),	Leavenworth, Kan.	Sept. 19
Oct. 7.	Iron bridge,	Brookings, S. Dak.	Sept. 19
Oct. 7.	Bridges,	New Berne, N. C.	Sept. 19
Oct. 7.	Piles (5,500), at Fort Delaware,	Del.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 3.		
Oct. 7.	20-in. cast iron pipe (120 ft.),	Baltimore.	Sept. 26
Oct. 7.	Sewer system,	Wausau, Wis.	Sept. 26
Oct. 7.	Granite block paving,	Albany, N. Y.	Sept. 26
Oct. 7.	Pipe sewers,	Albany, N. Y.	Sept. 26
Oct. 7.	Steel bridge,	Natchez, Miss.	Sept. 26
Oct. 8.	Water-wks system,	Grand Junction, Col.	Sept. 19
	Advertised, Eng. News, Sept. 19 to Oct. 3.		
Oct. 8.	Hydrants (20),	Winnipeg, Man.	Sept. 26
Oct. 8.	Iron bridge,	Tell City, Ind.	Sept. 26
Oct. 8.	Asylum buildings,	Boulder, Mont.	Sept. 26
Oct. 8.	Repairing bridge,	Oswego, Kan.	Sept. 26

Oct. 8. Wagon road, Bozeman, Mont.....Sept. 26
Oct. 8. Iron bridges (5), Beatrice, Neb.....Sept. 26
Oct. 8. Belgian block paving, Jersey City, N. J. Sept. 26
Oct. 9. Paving, Ansonia, Conn.....Sept. 26
Advertised, Eng. News, Sept. 26.
Oct. 9. Brick paving, Cleveland, O.....Sept. 19
Oct. 9. Sale of canal, Annapolis, Md.....Aug. 22
Oct. 9. Water-works crib, Cleveland, O.....Sept. 12
Oct. 9. Traveling cranes (2), Cleveland, O.....Sept. 12
Oct. 9. Mechanical stockers, Cleveland, O....Sept. 12
Oct. 9. Dimension block paving, Ansonia, Conn. Sept. 26
Advertised, Eng. News, Sept. 26.
Oct. 9. Disinfecting plant at San Diego, Cal..Sept. 26
Oct. 10. Pipe sewers (7,084 ft.), Warren, O.....Sept. 19
Oct. 10. Pipe sewers, Scottdale, Pa.....Sept. 26
Advertised, Eng. News, Sept. 26 and Oct. 3.
Oct. 10. Macadamizing, New Milford, Conn....Sept. 26
Oct. 10. Main sewer, Carbondale, Pa.....Sept. 26
Advertised, Eng. News, Sept. 26 and Oct. 3.
Oct. 10. Steel bridge, Delaware, O.....Sept. 26
Oct. 12. River improvements, Richmond, Va....Sept. 26
Oct. 12. Asphalt paving, Indianapolis, Ind.....Sept. 26
Oct. 14. Use of sewage and land, Salt Lake City. Sept. 19
Oct. 14. Pipe sewers (15 m.), Far Rockaway, N.Y. Sept. 19
Advertised, Eng. News, Sept. 19 to Oct. 10.
Oct. 14. Intake pipes, Evansville, Ind.....Sept. 26
Advertised, Eng. News, Sept. 26 and Oct. 3.
Oct. 14. Pump well, etc., Evansville, Ind.....Sept. 26
Advertised, Eng. News, Sept. 26 and Oct. 3.
Oct. 15. Cast iron pipe, Jacksonville, Fla.....Sept. 19
Advertised, Eng. News, Sept. 19 to Oct. 3.
Oct. 15. Hydrants, etc., Jacksonville, Fla.....Sept. 19
Advertised, Eng. News, Sept. 19 to Oct. 3.
Oct. 15. Sewer pipe, Jacksonville, Fla.....Sept. 19
Advertised, Eng. News, Sept. 19 to Oct. 3.
Oct. 15. Artesian well, Jacksonville, Fla.....Sept. 26
Oct. 15. Water-wks system, Columbus Junc., Ia. Sept. 26
Advertised, Eng. News, Sept. 26 to Oct. 10.
Oct. 15. Water bonds, New Painesville, Minn...Sept. 26
Oct. 15. Cement sidewalks, Indianapolis, Ind....Sept. 26
Oct. 16. Plans for city hall, Somerville, Mass...Aug. 29
Oct. 18. Iron bridge, Oswego, Kan.....Sept. 26
Oct. 19. Public lighting, Knoxville, Tenn.....Sept. 19
Oct. 21. Pumping engine, Washington, D. C....Sept. 12
Advertised, Eng. News, Sept. 12.
Oct. 21. Moving stone in Kentucky.....Sept. 26
Oct. 21. Roof for pub. build'g, Washington, D.C. Sept. 26
Oct. 26. Bronze tablet, Gettysburg Military P'k. Sept. 12
Advertised, Eng. News, Oct. 3.
Oct. 30. Court house, South Bend, Ind.....Sept. 26
Nov. 1. Plans school building, Pittsburg, Pa....Aug. 8
Nov. 1. Plans for school building, Pittsburg, Pa. Sept. 26
Nov. 5. Pile bridges, Allison, Ia.....Sept. 26
Nov. 19. State capitol, Olympia, Wash.....Sept. 12
Advertised, Eng. News, Sept. 12 to Oct. 31.
Nov. 20. Drainage canal work, Chicago, Ill.....Sept. 26
Advertised, Eng. News, Sept. 26 to Nov. 14.
Dec. 2. Sewers (22 miles), Mobile, Ala.....Sept. 19
Advertised, Eng. News, Aug. 29 to Oct. 24.
No date. Artesian wells, Nyack, N. Y.....Sept. 19
Advertised, Eng. News, Sept. 19.

RAILWAYS.

East of Chicago.

BLACK RIVER.—Surveys for this railway were made in 1894 by Geo. A. Ayer, Ch. Engr., Perkinsville, Vt. The line is projected from a connection with the Central Vermont, near Bellows Falls, Vt., to Springfield, Vt., 11 miles. The Springfield, Vt., "Reporter" states that Adna Brown, of that place, has received a letter from Guy Wilkinson, of Boston, offering to build the road, if the town of Springfield will raise $30,000.

DAYTON & EATON.—Incorporated in Ohio, Sept. 20, to build a railroad in the counties of Preble and Montgomery, Ohio, from a point on the west line of Preble county, southeastery from Richmond, Ind., near where the railway between Richmond, Ind., and Eaton, O., crosses said line, to a point just east of Dayton, O.; capital stock, $10,000; incorporators, John W. Stoddard, W. P. Callahan, B. C. Rice, E. M. Rice, and J. K. McIntire; principal office, Dayton, O.

LE ROY & NORTHERN.—The Le Roy, N. Y., "Courier" states as follows: Now that the trustees have granted a franchise for the construction of the Le Roy & Northern R. R., the work of building will be pushed as fast as possible. John N. Champion, a veteran at the business, has secured the contract for grading. The following officers have been elected: Pres., Chas. F. Prentice; Vice-Pres., N. B. Keeney; Treas., C. N. Keeney; Secy., D. C. Howard Prentice; Man., John P. Samson; General Freight Agt., Chas. H. Root; Assistant, J. Spencer Carr.

PENNSYLVANIA.—Press reports state that this company is taking steps to resume work on several branch lines upon which operations were temporarily suspended last year. Among the more important of these is the Rustleton Branch, a line extending from a point above Hart's Lane crossing, on the New York Division, to Rustleton, a distance of 7¾ miles. Actual work upon this branch had been commenced, when the panic came on, and some $80,000 was expended in grading and on crossings, when all operations were suspended. It is claimed that the renewal of operations is being considered by President Roberts, who is now reviewing the plans, and that they will be turned over to Chief Engineer Brown within a week or 10 days, with instructions to invite bids for the work.

RONDOUT & SOUTHWESTERN.—Incorporated in New York to construct a standard-gage steam railway, 34 miles in length, from Summitville, Sullivan county, to the city of Kingston; capital stock, $500,000; directors, Charles D. Haines, Andrew G. Haines, and Lafe Pence, of Kinderhook; S. D. Lake, C. R. Howell, W. H. Nessnass, H. J. Cox, and P. E. Farnum, of Port Jervis, and John Milton, of Medusa. This is the proposed extension of the Port Jervis, Monticello & New York.

WHEELING & LAKE ERIE.—A final survey has been made for the proposed extension of this railway from Steubenville, O., into Pittsburg. Several new bridges are contemplated. Gen. Man., A. G. Blair, Toledo, O.

Southern.

CAROLINA, TENNESSEE & OHIO.—Organized at Southport, N. C., Sept. 20, to build a railway from Southport to Wilmington; capital stock, $500,000; Pres., J. E. Challenger, Gen. Man. Car Service Association, Philadelphia, Pa.; Vice-Pres. Stephen Green, Philadelphia; Secy. and Treas., P. R. Foley, Treas. Reading (Pa.) Rolling Mill Co.; Gen. Supt., H. H. Dougherty, Newark, N. J.; Gen. Counsel, John D. Bellamy, Jr., Wilmington, N. C. The Union Construction Co. was also organized, with the same officers, H. H. Dougherty being both superintendent of construction and chief engineer.

GEORGIA PINE.—Incorporated in Georgia, with a capital stock of $160,000, to build a railway from Bainbridge to Arlington, 42 miles, through extensive pine forests. J. P. Williams and E. A. Cutts, of Savannah, and H. L. Hawes, of Bainbridge, Ga., are interested.

HOLSTON VALLEY.—This railway will probably be in operation by Jan. 1. Tracklaying is expected to be commenced Oct. 1. The Wiley Boom & Lumber Co., of Bristol, Tenn., is interested.

TENNESSEE.—The Bristol, Tenn., "News" states that Burney Burleson and a corps of surveyors will begin this week to survey a new railway from Hampton, Tenn., to a new mine 15 miles southeast of there, at a cost of $10,000 a mile.

Northwest.

CHICAGO & LAKE SUPERIOR.—The Madison, Wis., "Democrat" states as follows: At a meeting of the Chicago & Lake Superior R. R. Co., held at Madison last week, E. J. Foster, of Madison, was elected president; C. G. Norton, of Osonomowoc, general manager, and F. P. Hanchett, secretary. A contract was signed with Thomas Appleby & Co., of Chicago, for the construction of the first section, 14 miles. N. W. McGrath, one of the firm and superintendent of construction, is now making a preliminary survey. This company acquired the charter of the Koshkonong Valley R. R. from London to Cambridge, changing the name to Chicago & Lake Superior R. R., with additional privilege of building a road from the south line of the state through to Lake Superior.

CHICAGO, FAIRCHILD & EAU CLAIRE RIVER.—The Fairchild, Wis., correspondent of the Milwaukee "Sentinel" states that work on the extension of this railway is progressing rapidly, and in a few months it will be completed. The grading is nearly completed, and is within one mile of Greenwood. The laying of rails has already begun. The N. C. Foster Lumber Co., of Fairchild, built ten miles of this road some time ago for logging purposes, but decided to push the road northeast about 25 miles. The Fosters have not decided yet whether to push into Greenwood and connect with the Wisconsin Central or go further north for connections. The Foster company built and operated for several years the Mondovi branch of the Omaha road, and has had much experience in railway building.

CHICAGO & WISCONSIN INLAND LAKES.—Incorporated in Wisconsin Sept. 22, to build a railway 185 miles in length, from Chicago to Watertown, Janesville, Madison, and other cities in Wisconsin; capital stock, $10,000,000, divided into $10 shares; directors, A. E. Chase, Frank Boden, G. D. Green, S. Marcus Rothschild and A. J. Toolen, all of Chicago.

TERRE HAUTE, SAYLOR SPRINGS & MOUNT VERNON.—This projected railway was noted last week. A press report from Saylor Springs, Ill., states that Richard H. Cole, Ch. Engr., has just completed the preliminary survey of the line in Illinois from Mount Vernon to the Wabash River. The line as located will touch the towns of Ingraham, Bogota, Newton, Hunt City, and West York, between Saylor Springs and the Wabash River. The company may decide to make Centralia, Ill., its southwestern terminal instead of Mount Vernon and connect with the Centralia & Chester instead of the Wabash, Chester & Western at Mount Vernon. Should this be done the line will cross the Springfield division of the Baltimore & Ohio Southwestern at Louisville, and the main line of the Baltimore & Ohio Southwestern at or near Salem, Ill.

YANKTON & NORFOLK.—Press reports from Yankton, S. Dak., state that the contracts for completing this railway were signed Sept. 11. About 30 miles of the line was graded several years ago, and some $600,000 spent on the work. Senator R. F. Pettigrew, of Sioux Falls, S. Dak., is interested. It is stated that the Great Northern will operate the road.

Rocky Mt. & Pacific.

COLUMBIA & RED MOUNTAIN.—D. C. Corbin, of Spokane, Wash., Pres. Spokane Falls & Northern, has filed a new map of this proposed railway, and it is hoped to build 7½ miles of the road at an early date.

MONTANA.—The Helena, Mont., "Independent" of Sept. 10 contains a sketch showing the progress of construction on this railway toward the Castle Mines. About 12 miles of grading has been completed, and tracklaying will be commenced as soon as the rails are received. Ch. Engr., A. G. Lombard, Helena.

NEVADA SOUTHERN.—A press report from San Bernardino, Cal., states that a new company has been organized to purchase the Nevada Southern at a receiver's sale and extend that line to Pioche, Nev. The new organization will be known as the California & Eastern R. R. Co., and is composed of Denver, Chicago and English capitalists. R. W. Woodbury, of Denver, will be business manager. R. S. Seibert, of Los Angeles, the receiver, is now on his way east to confer with the members of the new organization, and the conference will determine the day of sale of the Nevada Southern. Early this winter the road will be extended 100 miles to Pioche, passing through the Vanderbilt-Waupah mining districts, through the rich agricultural lands of Pahrump Valley and the mining districts of that locality.

STREET AND ELECTRIC RAILWAYS.

BURLINGTON, VT.—The Winooski & Burlington St. Ry. Co. has decided to extend its electric railway in the southern part of the city, and also from Church and Pearl Sts. to the road leading to Rock Point Institute.

HOLYOKE, MASS.—Chas. E. Ball, John Delaney and others have petitioned the Holyoke St. Ry. Co. to extend its electric road on High St. from Dwight to Lyman. Gen. Man., Wm. S. Loomis.

SHREWSBURY, MASS.—Stephen Shaw, A. H. Plympton and H. A. Maynard have been appointed a committee to confer with the Worcester Consolidated St. Ry. Co. and the State Central St. Ry. Co., in the question of extending their electric railways to Worcester.

MIDDLETOWN, CONN.—The Middletown St. Ry. Co. has been granted permission to extend its electric road for three miles, estimated to cost $40,000. Contracts for the construction will be awarded at once. Gen. Man. and Supt., E. W. Guss.

BROOKLYN, N. Y.—The Brooklyn City R. R. Co. is about to extend its electric road to Flushing, according to reports. Pres., Clinton L. Rossiter.

NEW YORK, N. Y.—The North New York City Traction Co. has been incorporated to construct a street railway in New York city about 21½ miles long; capital stock, $210,000. The road will extend from Willis Ave. and East 134th St. to Lafayette Ave. at the Bronx River. Directors, Henry Siebert, Frederick H. Benedict, James H. Haslin, William T. Ryan, Thomas L. Hughes, and Edward J. McGoldrick, of New York; John A. Hamilton, U. S. Grant and C. Tag, of Brooklyn.—The Southern Boulevard R. R. Co. has applied to the secretary of state at Albany for permission to extend its road. Pres., John W. McNamara.

SULLIVAN, N. Y.—The Chittenango & White Sulphur Springs Ry. Co. has been incorporated with a capital stock of $150,000 to construct and operate a street railway about 6 miles long in Madison county. The termini are, northerly, the New York Central & Hudson River R. R. tracks at Chittenango; and, southerly, the southerly boundary line of the town of Sullivan. Directors, Charles F. Pennock, George Walrath, George C. Clark, Walter H. Stewart, Lake McHenry, William H. Young, of Chittenango; Walter J. Roberts, of Franklin, N. J.; Henry C. Blackman, of Brooklyn; William Sutphen, J. F. Sprain, J. B. Dickinson, Austin J. Roberts, Henry E. Parson, K. J. Matheson and J. F. Clark, of New York.

ASBURY PARK, N. J.—The Asbury Park, Bradley Beach, Belmar & Spring Lake St. Ry. Co. was incorporated Sept. 23 to construct an electric railway in Neptune and Wall townships, and in Asbury Park and Belmar; capital stock, $75,000; incorporators, Henry C. King, New York, N. Y.; Alexander Bogey, Brooklyn, N. Y.; N. E. Buchanan and John Hubbard, Asbury Park, and Chas. H. Seaman, Bradley Beach.

CHESTER, PA.—It is reported that the directors of the Media, Middletown, Aston & Chester Electric Co. have voted to increase the capital stock from $30,000 to $150,000 for the immediate construction of the road, plans for which are now being considered.

STROUDSBURG, PA.—The Delaware Valley Electric R. R. Co. has been reorganized with a capital stock of $300,000. Pres., J. H. Shull; directors, John M. Hill, M. F. Coolbaugh, A. W. Loder and others.

WINTON, PA.—The Archbald Electric St. Ry. Co. was incorporated Sept. 23, to build a road between Archbald Borough, Jermyn, and Winton, Pa.; capital stock, $30,000, with $10,000 paid in; Pres., James Kane, Winton.

BALTIMORE, MD.—Bids are asked until Oct. 1 for constructing the power plant for the Baltimore, Middle River & Sparrows Point Ry. Ch. Engr., Chas. B. McClean.

RICHMOND, VA.—It is reported that contracts will soon be awarded for 20 motor cars. Address A. Langstaff Johnson, Richmond.

ATHENS, GA.—The Athens St. Ry. Co. has awarded to J. W. Taylor the contract for constructing its electric power plant.

SANDUSKY, O.—W. W. Graham, of Norwalk, and Clark Rude, of Sandusky, are the promoters of a proposed new electric road from Sandusky to Seven Mile House, Bloomville, North Monroeville, Monroeville and Bellevue.

YOUNGSTOWN, O.—It is reported that the Park & Falls Electric Ry. Co. will increase its capital stock from $50,000 to $200,000. It has in contemplation the building of a line to the coal fields, about eight miles south of this city.

SAGINAW, MICH.—The Saginaw & Bay City Rapid Transit Co. has petitioned for permission to extend its electric road in 12 streets.

PEKIN, ILL.—The Richwoods Ry. Co. has been incorporated to construct a street railway through the counties of Peoria, Tazewell and Woodford; capital stock, $50,000; incorporators, Robt. M. Cox, James M. Morse and Theo. J. Miller.

SAN JOSE, CAL.—L. M. Hale, San Jose, has petitioned the board of trade for a franchise for an electric railway to Saratoga.

ELECTRIC LIGHT AND POWER.

STOWE, VT.—The question of electric lights is being considered.

PALMYRA, N. Y.—It is reported that W. D. Wilcox & Son have decided to erect an electric light plant on land owned by T. V. Cleveland.

WILMINGTON, DEL.—The Wilmington Light, Heat & Power Co. has voted to have plans prepared for a plant, according to reports.

COLUMBUS, GA.—The Columbus Iron Works Co. is about to buy a 50-HP. motor.

UNION SPRINGS, ALA.—The city desires to grant an electric light franchise. D. A. Sissions, Mayor.

HAMMOND, LA.—It is reported that H. E. Rhenbottom and York A. Woodward, of New Orleans, are preparing to construct an electric light and power plant.

HUBBARD, O.—The citizens have voted to construct an electric light plant, at an estimated cost of about $10,000. John Powers, W. R. Wadsworth and G. R. Stevenson are interested.

BUCHANAN, MICH.—An electric power plant to operate the water-works is proposed. O. D. Kent, Village Clk.

NASHVILLE, MICH.—The construction of an electric light plant is being considered, according to reports.

CLOQUET, MINN.—The question of putting in an electric light plant is being discussed.

NEW COMPANIES.—Tennessee Electric Light & Power Co., Knoxville, Tenn.; $30,000; Pres., C. C. Howell; Secy., W. S. Shields; W. A. Park, H. L. McClung.—Riverside Gas Light & Heat Co., Riverside, Ill.; $100,000; L. K. Highland, J. E. Sutherland, J. Donn.—Bethel Electric Lighting & Power Co., Bethel, Vt.; $15,000; W. H. Creamer, R. M. Chase, George H. Almon.—Werner-Schenk Co., Milwaukee, Wis.; $6,000; to manufacture brass goods and electrical supplies; F. M. Werner, Arthur J. Schenck, F. P. Werner.—Newton Electric Co., Newton, Ia.; $25,000; Pres., R. E. Sunny; Treas., James S. Cummins; Secy., H. M. Vaughan.—Huntington Gas Co., Huntington, N. Y.; $90,000; to supply gas and electricity; L. B. Gleason, 44 Wall St., New York, and W. D. Hard, New York; Victor Cumberson, Brooklyn.

BRIDGES.

BROOKLINE, MASS.—The Boston Park Commissioners are considering the question of constructing a new bridge over the parkway, at Longwood Ave., at an estimated cost of $153,000. A preliminary plan has been made by Shepley, Ruten & Coolidge, of Boston.

TAUNTON, MASS.—Plans have been prepared for a trestle bridge over the Old Colony R. R. at Duval St. for the Globe St. Ry. Co.'s line. The structure will be 1,000 ft. long, 15 to 22 ft. wide and 24 ft. above the tracks.

FAIRPORT, N. Y.—Bids are asked until Oct. 4 for constructing the superstructure for an iron bridge over the Erie Canal at Main St. R. G. Lay, Asst. Supt. Pub. Wks., Rochester; Geo. W. Aldridge, Supt. Pub. Wks., Albany.

NEW BRUNSWICK, N. J.—It is reported that the Pennsylvania R. R. Co. intends to elevate its tracks through New Brunswick at an estimated cost of $2,000,000. The first step has been taken by the beginning of a new four-track bridge across the Raritan River.

PITTSBURG, PA.—The grand jury has approved the report of the board of viewers, and has recommended that a bridge be constructed over Pine Creek, to be paid for by Allegheny county. Engr., Chas. Davis.

POTTSVILLE, PA.—Bids are asked until Sept. 30 for constructing two iron bridges. P. J. Connell, Clk. Comrs. Schuylkill county. Chas F. Allen, Comr.

BALTIMORE, MD.—A plan has been made of the proposed boulevard to connect Druid Hill and Clifton parks. A bridge 900 ft. long would have to be built from the park across the Northern Central R. R. tracks and Jones' Falls to the Falls road and Hickory Ave., and is estimated to cost about $280,000. Engr., W. P. Twamley.——The engineer has applied for an appropriation of $90,000 for completing the North Ave. bridge.

WASHINGTON, D. C.—C. B. Hunt, engineer in charge of bridges, in his annual report to the district commissioners, recommends that the appropriation for ordinary care of bridges and for construction and repair of bridges be consolidated into a single one. He advises that the K St. bridge over Rock Creek be reconstructed at an estimated cost of $20,000; that the Navy Yard bridge over the Eastern branch be reconstructed at a cost of $250,000, and that the M St. bridge over Rock Creek be reconstructed with a paved floor system at an estimated cost of $30,000. The report also recommends that the approaches and superstructure of the P St. bridge over Rock Creek be widened and the bridge provided with a paved floor system, at an estimated cost of $35,000. Mr. Hunt further points out the necessity of a masonry or metallic bridge to be constructed over Rock Creek on the line of Massachusetts Ave., at an estimated cost of $175,000. For the regular annual appropriation for bridges the sum of $25,000 is recommended.

TARBORO, N. C.—Bids and plans are asked by the commissioners of Edgecombe county for constructing a 30-ft. draw in the bridge at this place, and also in the bridge three miles above Tarboro. Address Orren Williams, Tarboro.

NATCHEZ, MISS.—Bids are asked until Oct. 7 for constructing anew steel bridge over St. Catharine's Creek, on the Liberty Road. Oliver N. Wilds, Pres. Bd. Supervisors; Allison H. Foster, Clk.

KNOXVILLE, TENN.—The county commissioners are considering the question of constructing a stone or steel bridge over the Tennessee River at Gay St., at an estimated cost of $150,000 to $200,000.

COLUMBUS, O.—The following bids were received Sept. 14 for constructing a plate girder bridge 67 ft. long over the canal on the Rauck road; Wm. H. Halliday, County Audr.:

Wrought Iron Bridge Co., Canton, O.	$1,750
Champion Bridge Co., Wilmington, O.	1,926
Frank C. Lewis	1,840
Penn Bridge Co., Beaver Falls, Pa.	1,790
Youngstown Bridge Co., Youngstown, O.	1,813
Massillon Bridge Co., Massillon, O.	1,845
Toledo Bridge Co., Toledo, O.	1,775
Indiana Bridge Co., Muncie, Ind.	1,895
Geo. W. Knopf, Pittsburg, Pa.	1,400
Iron Substructure Co., Columbus, O.	1,862
New Columbus Bridge Co., Columbus, O.	1,740

DELAWARE, O.—Bids are asked until Oct. 10 for constructing a 148-ft. span steel bridge over the Olentangy River, between Delaware and Marion counties. Lyman P. Lewis, Audr. Delaware county.

MIDDLETOWN, O.—The county commissioners have decided to build a lift bridge over the canal at Main St.

TELL CITY, IND.—Bids are asked by the board of Perry county until Oct. 8, for constructing an iron bridge over Sulphur Fork of the Anderson River at Ray's Ford. M. F. Casper, County Audr.

MARINETTE, WIS.—The following bids were received Sept. 9 for constructing the paper mill bridge over the Menominee River to Menominee, Mich.; G. C. Rathbun, Cy. Clk., Marinette; E. L. Shaw, Cy. Engr.:

J. E. Utke, Marinette	$5,497
A. F. McGillis, Menominee, Mich.	5,000
P. S. Loy, De Pere, Wis.	5,198
Calix Merchant, Marinette	5,150
Sanderson & Nelson, Marinette	4,875
W. D. Van Norman,* Minneapolis	4,800
John Martin, Oshkosh, Wis.	4,975
McGrath & Anderson, Green Bay, Wis.	4,920

* Awarded contract.

RACINE, WIS.—The Chicago, Milwaukee & St. Paul R. R. Co. is making arrangements to construct a new bridge over Root River at an estimated cost of $6,000, according to reports.

ALLISON, IA.—Bids are asked until Nov. 5 for constructing wooden or pile bridges in Butler county, as may be directed by the board of supervisors during one year. Geo. W. Conn, Audr. Butler County.

OTTUMWA, IA.—The council is considering the question of constructing a new bridge over the Des Moines River.

ERIE, KAN.—The county commissioners have received the following bids for constructing three highway bridges, 93 ft., 77½ ft. and 62 ft., respectively:

Wrought Iron Bridge Co., Canton O.	$1,488	$1,184	$830
King Bridge Co., Cleveland O.	1,640	1,300	900
Kansas City Bridge Co., Kansas City.	1,538	1,240	875
Farnsworth & Blodget Co., Kan. City*.	1,466	1,196	838

* Awarded contracts.

OSWEGO, KAN.—Bids are asked until Oct. 8 for repairing a bridge over Neosho River, 120 ft. long and 17 ft. wide, and until Oct. 18 for constructing an iron bridge 40 ft. long over Labette Creek. J. F. Thompson, County Clk.

PHILLIPSBURG, KAN.—Bids are asked until Oct. 10 for building a steel bridge over the Solomon River at Logan. Bridge to be either a single span of 120 ft., or a two-span bridge of 70 ft. each., and also for a steel bridge, 60 ft. long, over Prairie Dog Creek at Long Island. I. D. Thornton, County Clk.

TOPEKA, KAN.—The county commissioners are considering plans for a bridge over the Kansas River at Kansas Ave., submitted by Keepers, Wynkoop & Thatcher, 53 Telephone Bldg., Detroit, Mich., and by J. F. Hinckley, 2017 Rutger St., St. Louis, Mo. The bridge will be 700 ft. long, 40 ft. wide, and will have one span of 126 ft., two of 100 ft., two of 79 ft. each, and two of 5 8ft. each, and is estimated to cost about $135,000.

BEATRICE, NEB.—Bids are asked until Oct. 8 for constructing the following one-span iron bridges: 40 ft. long, over the north branch of the Nemaha River, Adams township; 36 ft. long, over Sicily Creek, Sicily township; 36 ft. long, over Mud Creek, Rockford township; 65 ft. long, over Indian Creek, Wymore township; 28 ft. long over Ayres Branch in Island Grove township. F. E. Whyman, Chn. County Bd. T. E. Wilson, County Clk.

LITTLE ROCK, ARK.—It is reported that the construction of a bridge over the Arkansas River, is being considered again. Address J. A. Woodson.

DENVER, COLO.—The following bids were received Sept. 14 for constructing a steel bridge 128 ft. long over White River, in Rio Blanco county; H. A. Sumner, State Engr.: Wrought Iron Bridge Co., Robt. Z. Drake, Contracting Agent, Colorado Springs, Colo., steel cylinders, steel span, $3,918; stone abutments, grillage, steel span, $3,825; stone abutments, concrete, steel span, $3,443. Colorado Fuel & Iron Co., Denver, stone abutments, concrete, steel span, $3,500. Bullen Bridge Construction Co., Pueblo, Colo., stone abutments, concrete, steel span, $4,200; stone abutments, grillage, steel span, $4,700; steel cylinders and steel span, $4,200.

YANKTON, S. DAK.—It is reported that contracts have been awarded which will assure the early completion of the railway bridge over the Missouri River at this place, and work will be begun at once. R. F. Pettigrew, of Sioux Falls, is interested.

MONTESANO, WASH.—It is reported that the commissioners of Chehalis county, at their last session, approved the resolution of the council of Hoquiam relating to a drawbridge across the Hoquiam River, the width of the draw to be 125 ft.

STOCKTON, CAL.—The war department has granted the San Francisco & Joaquin Valley Ry. Co. permission to construct a steel drawbridge over Mormon Channel in this city, according to reports.

NEW WESTMINSTER, B. C.—It is reported that the Bullen Bridge Construction Co., of Pueblo, Colo., has been awarded the contract for building a railway bridge over the Frazer River, at about $400,000.

BUILDINGS.

PROVIDENCE, R. I.—Bids are asked until Sept. 30 for the plumbing work to be done in connection with the school building on Jackson Ave. David Burton, Chn. Com.; D. F. Hayden, Clk. Com.

BINGHAMTON, N. Y.—Bids are asked until Sept. 30 for constructing a fire engine house. Arch., A. W. Reynolds; Lewis Seymour, Cy. Clk.

BROOKLYN, N. Y.—Bids are asked by the committee of the board of supervisors of Kings county until Sept. 30 for ventilating and heating the Kings county court house.——Bids are asked until Oct. 1 for constructing a school building at Sterling Place and Vanderbilt Ave., and for an addition to public school No. 72 on Schenck St., and also for electric bell systems in three school buildings, and for heating and ventilating additions to two school buildings. John McNamee, Chn. Com. School Houses; John R. Thompson, Chn. Com. Heating.——Bids are asked until Oct. 1 for making alterations and constructing additions to the city hall; surety, $30,000; Alfred T. White, Comr. Cy. Wks.——The commissioner of city works has received the following bids for the structural steel and general ironwork for the city hall alterations and additions; Milliken Bros. (awarded contract), $57,450; Post & McCord, $59,000; J. T. Henley, $62,301; Poulson & Egger, $66,308.

BUFFALO, N. Y.—August Esenwein, 316 Pearl St., has prepared plans for a three-story brick and stone dwelling for Alfred Schoellkopf, on Delaware Ave., near Allen St., to cost $40,000. The contract for the construction has not yet been awarded.

NEW YORK, N. Y.—Plans have been filed by the Wm. F. Weld estate, 356 Bellevue Ave., for a 14-story brick building at Broadway and 12th St., to cost $300,000, and by Thos. F. White, 71 Lenox Ave., for a five-story brick apartment hotel at 118th St. and St. Nicholas Ave., to cost $125,000. Arch., Julius Munckowitz, 247 West 125th St.——Bids are asked by the commissioner of public works until Sept. 30 for furnishing a horizontal tubular boiler, smokestack, pipework, new radiators, repairs to heating system, new pumps, etc., for the old criminal court building, Chambers St.——The board of directors of the Mount Sinai Hospital is about to take action to collect the $700,000 subscribed some time ago to aid in the erection of the proposed new hospital, estimated to cost about $1,250,000. Supt., Leopold Minzesheimer; Pres., Henry Blum; Isaac Wallach, Vice-Pres. and Chn. Executive Com., 12 East 62d St.

ELIZABETH, N. J.—Bids are asked until Oct. 1 for constructing two brick wings to the almshouse. Arch., D. B. Provoost, 78 Broad St.; James J. Manning, Cy. Clk.

PHILADELPHIA, PA.—John R. Wiggins has been granted a permit to erect a six-story office building at 324 and 326 Market St. The building will be 180 × 35 ft., and is estimated to cost about $40,000.

PITTSBURG, PA.—Bids are asked until Sept. 30 for erecting two fire engine houses; two bonds of $25,000 each. Arch., Wm. Y. Brady, City Hall; J. O. Brown, Dept. Pub. Safety.——Plans are asked until Nov. 1 for a 20-room school building on Margaretta St., East End. D. A. Stevenson, Secy. School Bd.——General Superintendent Pitcairn, of the Pennsylvania R. R. Co., is quoted as stating that his company will, as soon as a site is selected, begin the construction of a depot at Pittsburg estimated to cost about $2,000,000.

WASHINGTON, D. C.—Bids are asked until Oct. 21 for furnishing a tin roof and copper gutter and cornice for the government printing office. Col. John M. Wilson, U. S. Engr.

LINVILLE, N. C.—A syndicate of northern capitalists, headed by John Wanamaker, of Philadelphia, is negotiating for the purchase of a large tract of land, embracing the principal portion of the site of this town, and will build there a number of houses and cottages and make other improvements. It is stated that several hundred thousand dollars will be expended.

RALEIGH, N. C.—The Diocese of the Episcopal Church for North Carolina will erect at this place a cathedral building to cost about $50,000. Address Rev. I. McK. Pittinger, rector, Church of the Good Shepherd, Raleigh.

ATHENS, GA.—Bids are asked until Oct. 1 for the erection of a new city prison on College Ave. J. W. Barnett, St. Comr.

ATLANTA, GA.—Plans are being prepared by Bruce & Morgan for a 10-story office building on Forsyth St., 239 × 119 ft., for William Austell.

MOBILE, ALA.—W. S. Foster, of Mobile, has been awarded the contract for the construction of the machine shops for the Mobile & Birmingham R. R. Co. on Royal St., near Bloodgood St. Supt., J. D. Clarke.

NEW ORLEANS, LA.—The comptroller has been directed to advertise for bids for reconstructing the old criminal court building.

NASHVILLE, TENN.—It is reported that bids will soon be asked for erecting the new prison buildings. W. M. Nixon, Secy. Bd. Prison Comrs.

PARIS, TENN.—Bids are asked until Sept. 30 for building a court house. W. D. Morris, Chn. Com.

SOUTH BEND, IND.—Bids are asked by the commissioners of St. Joseph county until Oct. 30 for constructing a court house to cost about $300,000; bond, $75,000. Robert Myler, County Audr.

MILWAUKEE, WIS.—H. C. Koch and Ferry & Clas have submitted plans for the new state historical society building, which will cost $400,000.

LESUEUR CENTER, MINN.—It is reported that this county has voted to construct a court house at this place, at an estimated cost of $40,000.

ST. LOUIS, MO.—M. A. Wolff & Co. are reported as about to construct a six-story office building on property leased by them at 15th and Olive Sts. The building will be 150 × 106 ft., and is estimated to cost $250,000. Archs., Barnett, Haynes & Barnett.

BOULDER, MONT.—Bids are asked until Oct. 8 for erecting buildings for the state deaf and dumb asylum. Arch., John C. Paulsen, Helena; M. H. Parker, Secy. Bd. Trustees

EMPIRE CITY, ORE.—The following bids have been received by the school directors for constructing a new school house: John Robertson, Portland, $12,729; W. D. Garrett, Portland, $12,729; W. R. Stokes & Co., Portland, $12,789; C. R. DeBurgh, Portland, $12,900; F. Wilson, Portland, $11,745; Lackstrom & Blumquist, Marshfield, $11,787; Smith & Perham Bros., Portland (awarded contract), $10,985.

WATER-WORKS.

GLEN, N. H.—We are informed that the Glen Water Co. has nearly completed its plant.

SOMERSWORTH, N. H.—The council has voted to reject all the bids received Sept. 16 for pipelaying, and to have the work done by the city or by local contractors employing only local help. The bids were as follows; Engr., Wm. Wheeler, 89 State St., Boston:

Joseph Bruno, East Boston, Mass.	$10,041
Thomas F. Maney & Co., Boston, Mass.	10,535
Little & Effle, Boston	11,158
John Walker & Co., East Rochester, N. H.	11,295
Donato Cuozzo, New York	11,415
F. E. Hall & Co., Quincy, Mass.	13,150
Severy & Pinney, Waterbury, Conn.	14,036
Snow & Moulton, Dover, N. H.	15,246
Cralb & Trumbull, Winthrop, Mass.	17,148
Great Falls Granite Co., Somersworth	17,380

ESSEX JUNCTION, VT.—S. A. Brownell writes us that before long the citizens expect to take some measures to provide the village with a system of water-works by gravity or pumping from the river by water power.

ARLINGTON, MASS.—The citizens have voted to appropriate $10,000 for the extension of the water mains in new streets.

BRADFORD, MASS.—The contract for building the new pumping station has been awarded to Westcott & Shannon, at $6,998; work will begin at once. The other bidders were Chas. G. Locke, $8,950; John M. Roche, $8,850; C. C. Cook, $8,500; N. S. Cole, $7,910; Kelley Bros., $7,375.

HATFIELD, MASS.—At a recent town meeting the citizens voted, 85 to 15, in favor of a public water supply. Water will be taken from Running Bitter Brook in the western part of the town. A dam will be built and a reservoir made about a mile above Srong's mill. A complete system of piping will be put in for West Hatfield and Hatfield Center. It is estimated that the entire cost of construction will be about $30,000.

LEOMINSTER, MASS.—C. A. Joslin, Town Clerk, writes us that this town is about to construct a new reservoir. Orders have been placed for pipe, hydrants, gates, etc. Specifications for the dam and basin are not yet ready. The work will cost about $125,000. Jonas W. Gates, Des. Engr.

SOUTH FRAMINGHAM, MASS.—A. E. Martin, Supt., writes us that plans for one or two new stand-pipes are being prepared by Lucian A. Taylor, of Boston. The location will be decided in a few days.

DANBURY, CONN.—Geo. C. Stevens, Supt., writes us that about three miles of 30-in. main and a new reservoir will soon be constructed, at a probable cost of $16,000. No date is yet set for the opening of bids. Chas. O. Brown, Cy. Engr.

ALLEGANY, N. Y.—The citizens have decided to vote on the question of incorporation. Should the proposition carry, it is stated that a water-works system will follow.

HEMPSTEAD (L. I.), N. Y.—Bids were opened Sept. 14 for the construction of water-works, and the contract was awarded to L. J. Richardson, Oswego, N. Y.,

who bid $45,914. Mr. Richardson is at present constructing works at Rockville Center.

LANSINGBURG, N. Y.—The citizens are talking of securing an additional water supply, as the present supply is insufficient; estimated cost, $100,000.

MILLBROOK, N. Y.—There is talk of incorporating the village, in order to obtain water-works.

POTSDAM, N. Y.—It is reported that an engineer will make an investigation and report on the most feasible system for this place.

RHINEBECK, N. Y.—We are informed that nothing has yet been done about water-works at this place.

SCHUYLERSVILLE, N. Y.—H. P. Smith, Town Clk., writes us that the question of water-works is being agitated, but that nothing else has yet been done.

SOUTH GLENS FALLS, N. Y.—John W. Burke, of New York, is investigating the question of a water supply for this place. It is thought that a system would cost about $35,000. H. B. Parks, Pres. Trustees.

THERESA, N. Y.—J. J. Makepiece, Pres. Bd., writes us that at an election Sept. 20, the citizens voted to construct works, estimated to cost $19,500. Bids for the construction will be asked as soon as possible.

TULLY, N. Y.—H. K. King, Village Clk., writes us that this village has voted to issue $10,000 in bonds for works. The water supply will be from wells already sunk, or by gravity from springs. W. L. Earle, J. S. Wright, J. M. Slayton, W. H. Dwinelle and W. A. Dewey constitute the water board.

BRIDGTON, N. J.—The council has appropriated $5,000 for increasing the water supply.

JERSEY CITY, N. J.—Bids are asked until Oct. 1 for furnishing all labor and material for an addition to stand-pipe at the high-service pumping station; and also for furnishing and delivering firebrick, lime, Portland cement and building sand until May 1, 1896. Specifications may be seen at the office of the chief engineer, Jersey Ave. and Mercer St. George T. Bouton, Clk. Comrs.; Wm. H. Hooker, Chn. Com.

ALLEGHENY, PA.—Bids are asked until Oct. 3 for the purchase of $650,000 of 4% water bonds. James Brown, Cy. Comptroller.

EAGLES MERE, PA.—The Eagles Mere Land Co. is reported as to construct works this fall, the plant to include a reservoir.

EAST GREENVILLE, PA.—There is talk of extending the works to Pennsburg.

JUNIATA, PA.—A proposition to issue $25,000 in bonds for works will be voted upon at the November election. H. A. Bratton, J. L. Hunt and Allen MacCartney are the committee.

KENNETT SQUARE, PA.—The contract for a 150,000-gallon stand-pipe has been awarded to the Pusey & Jones Co., of Wilmington.

NORWOOD STATION, PA.—The village of Norwood is considering the question of water-works and sewers; estimated cost, $30,000; Engr., Enon M. Harris, Jr., of Collingdale, Pa.

PITTSBURG, PA.—Bids are asked until Sept. 28 for renewing portions of the old rising main at the Brilliant pumping station. E. M. Bigelow, Dir. Pub. Wks.

ROCHESTER, PA.—The council is reported to have voted to construct works.

STRASBURG, PA.—Edgar B. Kay, of Quarryville, Pa., is preparing plans for gravity works for the Strasburg Water Co., recently incorporated.

BALTIMORE, MD.—Bids are asked until Oct. 4 for 15 tons of Omaha pig lead, and until Oct. 7 for 10 pieces of 20-in. cast iron pipe, each 12-ft. long and ⅝-in. thick. Wm. L. Kenly, Acting Ch. Engr.; Janon Fisher, Cy. Comr.

PRINCESS ANNE, MD.—The town commissioners have contracted with Chas. S. York, of Chestertown, Md., to construct works, estimated to cost $10,000, the plant to be completed within eight weeks.

CULPEPER, VA.—The contract for constructing works is reported to have been awarded to A. B. Luck, of Roanoke, Va., at $31,792. The bids were as follows. R. S. Boonton, Chn. Com.; N. Wilson Davis, Engr.:

Geo. R. Hebert, Washington, D. C.	$43,000
A. B. Luck, Roanoke, Va.	31,792
*Hebert & Lapeyre, Chattanooga, Tenn.	30,577
Hankins & Mosby, Richmond, Va.	33,000
Owen Patterson, Baltimore, Md.	34,009
E. S. Moorman, Lynchburg, Va.	36,507
*Herbert & Lapeyre, No. 2, by wire.	31,477

* Pronounced informal by the engineer.

MANASSAS, VA.—The citizens are reported as talking of constructing works.

JACKSONVILLE, FLA.—Bids are asked until Oct. 15 for sinking a 12-in. artesian well 900 ft. deep, and casing the same to a depth of 500 ft. R. N. Ellis, Supt.; D. F. Dillon, Chn. Com.

GREENUP, KY.—It is stated that this place will probably have works before next year. The question is now being agitated.

BEREA, O.—A. F. Goetle, Cy. Clk., writes us that at the election, Sept. 16, the water-works question was defeated.

BLUFFTON, O.—Will A. Triplett, of the water committee, writes us that an election will be held Oct. 21 to vote on an issue of $17,000 in bonds for works.

COLLEGE HILL, O.—F. R. Strong, Clk., writes us that E. F. Layman has prepared estimates for works which will probably cost $43,000, and that it is probable that the question will be voted upon at the next election.

DALTON, O.—The contract for constructing works has been awarded to H. D. Shannon for the works complete, except the engine house. The bids were as follows:

H. D. Shannon, Orrville, O.	$6,862
McQuern & Co., Canton, O.	7,067
Vissiart & Dutton, Alliance, O.	7,930
O. R. Hine, Scio, O.	7,821
L. G. Hallock, Wheeling, W. Va.	8,071

HIRAM, O.—The proposed works, recently noted, are estimated to cost $8,000. The question of construction has not yet been decided. E. L. Hall, Clk.

MILLERSBURG, O.—Snyder & Williams have just broken ground for the reservoir to the water-works. Our correspondent writes us that the natural conditions for locating a reservoir for pressure can scarcely be excelled in Ohio, and that Millersburg will have a fire service excelled by no town in the state when the plant is completed. Burton J. Ashley, of Chicago, is the designing and constructing engineer.

MT. VERNON, O.—C. W. Koons, Supt., writes us that this city wishes to exchange a 750,000-gallon Worthington pump for a 2,000,000-gallon compound duplex pump to work against 230 ft. head and a lift of 17 ft.

NORWALK, O.—John Laylin, Cy. Engr., writes us that plans will soon be ordered for two storage reservoirs, with new pumping station, a stand-pipe and for extensions of the mains.

OSBORN, O.—O. B. Kauffman, Clk., informs us that the following bids were received for constructing works:

J. E. Fight & Co., Dayton, O.	$20,900
Louis Mayer, Wapakoneta, O.	21,500
Taft & Dole, Columbus, O.	21,178
R. N. Andrews, Hamilton, O. (awarded contract).	20,687

PAINESVILLE, O.—At an election Sept. 17 the citizens voted, 742 to 97, to issue $125,000 in bonds for the construction of new works. This is a result of the trouble with the Painesville Water-Works Co.

ALBION, IND.—The Albion Water Co., recently incorporated, has awarded the contract for a combined water-works and electric light plant to the Fort Wayne Electric Corporation, the work to be commenced at once and be completed by Jan. 1.

EVANSVILLE, IND.—Bids are asked until Oct. 14 for three lines of cast iron intake pipe, and for a pump, well, etc., as described in our advertising columns. P. Herrmann, Chn. Trustees; L. Weinheimer, Clk. W. W.

LAPORTE, IND.—Bids are asked until Oct. 1 for a 5,000,000-gallon pumping engine. G. R. Tyrrell, Supt.

MIDDLETOWN, IND.—The citizens have voted, 275 to 58, to construct works, estimated to cost $15,000.

ADRIAN MICH.—The council has notified the water company that it considers its contract with the city invalid, and will pay no more rent, alleging that water has been taken from the river and that no proper effort has been made to secure a supply from prings or wells, and charging that the machinery has not been kept in proper order.

COOPERSVILLE, MICH.—Geo. W. Bevins, Village Clk., writes us that the water-works proposition failed to carry, but that the question will probably come up again.

ESCANABA, MICH.—Henry Wilke, Clk., writes us that nothing will be done about works this year.

ROCKFORD, MICH.—Bids are asked until Oct. 2 for constructing a system of water-works, as stated in our advertising columns. J. M. Spore, Village Clk.

TRENTON, MICH.—Harry Wickins and John A. Russell, of Detroit, have petitioned the council for a franchise for works.

ASTORIA, ILL.—G. W. Stantwater, of Chicago, has submitted plans for works estimated to cost $21,650, complete.

CHENOA, ILL.—Bids are asked until Sept. 30 for steel reservoir, deep well pumping machinery, etc. Engr., George C. Morgan, 1012 New York Life Bldg., Chicago; Fritz Ramsdorf, Cy. Clk.

DESPLAINES, ILL.—A water supply has been secured from an artesian well, and it is stated that a stand-pipe will be erected and mains laid through the village.

EVANSTON, ILL.—The council has purchased a new Holly pump, to cost $32,500.

JOLIET, ILL.—Frank W. Dewey, Supt., writes us that about 1,000 ft. of 8-in. and 2,000 ft. of 6-in. pipe will be laid. Gray Bros., of Chicago, have been awarded a contract for sinking a 12-in. well 1,750 ft. deep. There is some talk of adopting meters for the large consumers.

LA GRANGE, ILL.—The following bids were received Sept. 20 for constructing works; Engrs., Ewing & Waite, La Grange:

C. & T. Iglehart, Morgan Park, Ill.	$13,832
A. Cleary	13,869
S. I. Pope, Chicago	14,985
Thacher & Bunke	14,013
Burns & Esson, Chicago	15,120
T. W. Kinser & Sons, Chicago	16,137

The prices of the lowest bid were as follows: For furnishing and laying pipe; 8-in., 3,000 ft., at 70 cts.; 6-in., 9,348 ft., 61 cts.; 4-in. 3,614 ft., 44 cts.; lead service pipes, 42 cts.

LINCOLN ILL.—The Lincoln Water & Light Co. has purchased $16,000 worth of new machinery.

MAPLE PARK, ILL.—It is reported that the Challenge Wind Mill & Feed Mill Co. submitted the lowest bid last week for constructing works, at $3,270, and that it is probable that all the bids will be rejected and the plans changed.

MORRIS, ILL.—J. P. Miller & Co., of Chicago, have been awarded a contract for sinking a 12 to 10-in. artesian well 1,000 ft. deep at this place for the Chicago, Rock Island & Pacific Ry. Co.

TOLUCA, ILL.—An election will be held Sept. 28 to vote on the construction of water-works.

BERLIN, WIS.—At a meeting of the council recently it was decided to advertise for bids for constructing works, according to press reports.

FORT ATKINSON, WIS.—W. O. Hoffmann, Cy. Clk., writes us that at the special election Sept. 17 the proposition to issue bonds for works was defeated.

OCONOMOWOC, WIS.—At an election Sept. 17 the proposition to issue bonds for works was defeated by a large vote.

WATERTOWN, WIS.—Plans for works estimated to cost about $100,000 have been completed by Geo. C. Morgan, of Chicago.

COLUMBUS JUNCTION, IA.—Bids are asked until Oct. 15 for constructing works, as stated in our advertising columns. Engrs., Crellin & Lovell, Des Moines; C. M. Fulton, Mayor.

LA PORTE CITY, IA.—The La Porte City Electric Light & Water Co. informs us that plans and specifications will be completed within a few days for its new plant.

NORA SPRINGS, IA.—The local paper is agitating the question of water-works.

SIGOURNEY, IA.—Geo. W. Wynn, Engr., of Cedar Rapids, informs us that the contract for constructing works, as advertised in Engineering News, has been awarded to the Challenge Wind Mill & Feed Mill Co., the bids being as follows:

C. C. Horner, Sigourney, Ia.	$18,500
W. B. Clements, Agency, Ia.	18,987
D. P. Swalla, Sigourney, Ia.	19,933
Challenge Wind Mill & Fd. Mill Co., Batavia, Ill.	20,040
Fairbanks, Morse & Co., Chicago, Ill.	20,228
U. S. Wind Engine & Pump Co., Batavia, Ill.	20,843
Edwards & Walsh Cons'n Co., Davenport, Ia.	21,000
B. Schriner, Des Moines, Ia.	22,280

BROWNTON, MINN.—F. L. Nichols, Recdr., writes us that the contract for constructing works has been awarded to Fairbanks, Morse & Co. at $5,985.

GROVE CITY, MINN.—At a special election Sept. 16 the citizens voted to issue $5,000 in bonds for works.

HECTOR, MINN.—At an election Sept. 17 this village voted to issue $7,000 in bonds for works.

NEW PAINESVILLE, MINN.—Bids are asked until Oct. 15 for the purchase of $5,000 in 6% 20-year water bonds. A. T. Watson, Village Recdr.

SLEEPY EYE, MINN.—A press report states that the contract for the new electric light and water-works building has been awarded to A. McLeod & Co., of Minneapolis, at $6,100.

OAKLEY, KAN.—Bids are asked for the purchase of $7,000 of 7% bonds voted for the construction of water-works. W. L. Camp, Cy. Clk., writes us that the city is out of debt and has money in the treasury; population, 500.

OSAGE CITY, KAN.—At an election Sept. 20 the water-works proposition was defeated.

KANSAS CITY, KAN.—The Metropolitan Water Co. has had plans and estimates prepared for a new reservoir at Quindaro. The plans have been forwarded to New York for approval.

GRANT CITY, MO.—The city has voted to issue $5,000 in bonds for works.

HICO, TEX.—The council has voted in favor of works, and it is stated that the materials have been ordered.

MANOR, TEX.—The Manor Water-Works Co., of Manor, Travis county, Tex., has been incorporated with a capital stock of $8,000, by J. W. Bidding, J. G. Wheeler, T. H. Barrow and others.

LISBON, N. DAK.—The citizens are discussing the question of works.

HELENA, MONT.—The water commissioners write us that the city intends to purchase the plant of the Helena Consolidated Water Co., but that no new work is contemplated at present.

MOUNT FOREST, QUE.—W. C. Perry, Town Clk., writes us that estimates have just been submitted for works, estimated to cost $26,000 or $46,000. Address W. G. Scott.

WINNIPEG, MAN.—Bids are asked until Oct. 8 for 20 post hydrants. B. E. Chaffey, Chn. Com.

IRRIGATION.

O'NEILL, NEB.—It is reported that the Golden Irrigation District has been organized, to build a ditch 250 miles long, to irrigate 500,000 acres of land in that part of the Elkhorn Valley which lies in the counties of Brown, Rock and Holt. Pres., E. F. Dodd, of Newport; Secy., E B. Brown, of Bassett.

NEW COMPANIES.—Forks Reservoir Drain & Irrigation Co., Denver, Colo.; Clara Brown Denig, J. L. Fulton, E. M. Jacobson.

Tzschuck Canal Co., Ord, Neb.; $50,000; to build an irrigation ditch about 30 miles long from Almeria down the Loup River, and probably later to Ord; Geo. B. Tzschuck, W. E. Babcock, O. L. Horr, M. E. Getter, D. A. Gord, H. A. Stewart.

SEWERAGE.

WATERVILLE, ME.—It is stated that the system will be extended to the western section of the city. I. E. Getchell, Cy. Engr.

ALBANY, N. Y.—Bids are asked until Oct. 7 for constructing a 15 and 6-in. pipe sewer in Broad St.; two sureties of $7,500 each. Thos. J. Lanahan, Clk.

ALTAMONT, N. Y.—The village board has been directed to engage an engineer to make surveys and prepare estimates for a system.

DUNKIRK, N. Y.—It is proposed to construct 15 and 10-in. pipe sewers in five streets. John F. Maloney, Cy. Clk.

NEW BRIGHTON, N. Y.—Bids are asked until Oct. 1 for constructing an outlet sewer to the Taylor St. sewer district. J. F. Grady, Clk. Bd. Trustees.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until Oct. 2 for constructing sewers in six streets.

NYACK, N. Y.—We are informed that our item of last week was incorrect, and that James S Haring advised against a combined system estimated to cost $200,000 and in favor of a separate system, to cost only $48,000, which he had designed. The vote for the second time upon this question will be taken Oct. 8.

SYRACUSE, N. Y.—Bids are asked until Sept. 30 for constructing a 40 × 60-in. brick sewer in North West St., and 15-in. brick sewer in Belden Ave. Henry C. Allen, Cy. Engr.

SYRACUSE, N. Y.—The following bids were received Sept. 17 for constructing 48 to 30-in. brick sewers in four streets: P. H. Harrison & Sons, $18,473; Thomas Marnell, $21,508; John W. Bustin, $17,124.

TRENTON, N. J.—Bids are asked until Oct. 1 for constructing sewers in four streets. C. Edward Murray, Cy. Clk.

CARBONDALE, PA.—Bids are asked until Oct. 10 for constructing an extension to the main sewer, as stated in our advertising columns. Walter Frick, Cy. Engr.; T. L. McMillan, Cy. Clk.

GETTYSBURG, PA.—Edgar B. Kay, Bellwood, Pa., has prepared plans for a system, estimated to cost $50,000, and which will include about 13 miles of pipe sewers, a sewage disposal plant, etc. The question of issuing bonds is being considered.

GROVE CITY, PA.—Surveys are being made for a system. J. B. Pearsall, Chn. Com.

PITTSBURG, PA.—Bids are asked until Sept. 27 for constructing 15-in. pipe sewers in about 30 streets. Edward M. Bigelow, Dir. Dept. Pub. Wks.

SCOTTDALE, PA.—Bids are asked until Oct. 10 for constructing about 16,930 ft. of 30 to 12-in. pipe sewers,

as stated in our advertising columns. E. L. Rutherford, Borough Secy.

BALTIMORE, MD.—Janon Fisher, Cy. Comr., has submitted the following estimates for reconstructing the Jenkins Run sewer which collapsed Sept. 6: Repairing old sewer northeasterly from Greenmount Ave., $15,000; repairing abutments and arch of old sewer from Greenmount Ave. to Girard Ave., $2,000; repairing old wood bottom of sewer, $8,000; rebuilding section washed out on the west side of Greenmount Ave., $1,800; building a new sewer in the beds of Girard Ave. and Greenmount Ave., $75,186. Total, $102,986. It is proposed to extend the Bruce Alley sewer in Clifton Ave. and Fulton St., and also to extend the Patapsco St. sewer.

MAYFIELD, KY.—The council is considering the question of constructing a system. J. N. Crutchfield, Cy. Engr.

SANDUSKY, O.—Bids are asked until Oct. 5 for constructing a sewer in Pearl St. A. W. Miller, Cy. Clk.

TOLEDO, O.—Bids are asked by the clerk until Sept. 30 for constructing a sewer.——The trustees of the insane asylum are considering plans for a better system of sewage disposal for the asylum property. C. O. Probst, Secy. State Bd. Health, and Chas. L. Parmelee, of Toledo, have submitted plans.

CRAWFORDSVILLE, IND.—Preliminary surveys have been made for a system which will probably be built next year. J. D. Tracy, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until Sept. 28 for constructing about 1,100 ft. of 15 to 6-in. pipe sewers. C. C. Brown, Cy. Engr.

ALTON, ILL.—It is proposed to construct a trunk sewer. Patrick Ward, Cy. Clk.

BELVIDERE, ILL.—Plans have been accepted for a system, and the construction will probably be begun in the spring. Geo. H. Hurlbert, Cy. Engr.; J. W. Atwood, The Rookery, Chicago, is interested.

CHICAGO, ILL.—The town trustees of Cicero have voted to construct a sewer 5½ miles long in Oak Park to Mud Lake, at an estimated cost of $200,000.

LA CROSSE, WIS.—Plans have been prepared for 3,850 ft. of 42 to 20-in. brick and a large amount of pipe sewers. Frank C. Powell, Cy. Engr.

MADISON, WIS.—The following bids have been received for constructing 5¼ miles of 15 to 6-in. pipe sewers. O. S. Norseman, Cy. Clk.:

K. A. Smith, Faribault, Minn. (awarded cont.)	$12,119
Nic. Quinn, Madison	13,500
N. F. Reichert Co., Racine, Wis.	13,729
John O. Jones, Racine	14,555
Geo. R. King & Co.	15,000
Kelly & Bucey, Madison	17,159
Geo. Kraft, Madison	18,338
Hauk & Metz, Madison	21,990
Blake & Kringle, Dubuque, Ia.	15,670

MILWAUKEE, WIS.—The board of public works has advertised for bids for building a 54-in. brick sewer 1,400 ft. long in Deer St., from Clement Ave. to South Bay St., and in South Bay St., from Deer St. to Russell Ave. This sewer will cross Deer Creek and connect with a portion already built through the rolling mill yards, emptying into the lake.

WAUSAU, WIS.—Bids are asked until Oct. 7 for constructing a system; bond, $1,000. J. H. Reiser, Chn. Com.; J. C. Kuhlmann, Cy. Clk.

MINNEAPOLIS, MINN.—It is proposed to construct sewers in six streets. Irving E. Howe, Asst. Cy. Engr.

EMPORIA, KAN.—It is proposed to construct 5,000 ft. of 8-in. pipe sewers. Richard Strout, Cy. Engr.

KANSAS CITY, KAN.—The council has awarded the contract for constructing a sewer in district No. 16 to R. E. Elea at about $30,000.

INDEPENDENCE, MO.—An election will be held Oct. 15 to vote on the question of issuing $50,000 in bonds for constructing a main sewer to the Missouri River. Engr., Wynkoop Kiersted, Kansas City.

ST. LOUIS, MO.—An ordinance has been introduced in the board of public improvements authorizing an appropriation $32,500 for a storm sewer at Tower Grove.

LITTLE ROCK, ARK.—The council is to be petitioned to construct a system to comprise 200 blocks, estimated to cost $53,264.

CLOVERDALE, CAL.—The construction of a system is being discussed, according to reports.

SAN MATEO, CAL.—Bids are asked for the construction of a system, according to reports. D. Bromfield, Cy. Engr.; R. H. Jury, Cy. Clk.

SANTA MONICA, CAL.—It is reported that this place has voted to issue $40,000 in bonds for a system.

UKIAH, CAL.—The construction of a system estimated to cost $25,000 is being considered.

COTE ST. PAUL, QUE.—Emile Vanier, 107 St. James St., Montreal, is preparing plans for a drainage system, according to reports.

GARBAGE DISPOSAL.

YONKERS, N. Y.—The garbage crematory of the city was burned Sept. 23; reported loss, $10,000

HOBOKEN, N. J.—The "Observer" states that Fred Kohlmeyer has patented a garbage crematory, and that Otto Neimaber and others are planning to erect a plant at Union Hill, at a cost of about $15,000. The site has been purchased.

CLEVELAND, O.—The Cleveland Reduction Co. has been incorporated to collect and destroy garbage and analogous matter, and deal in the products of the same; capital stock, $18,000; incorporators, A. S. Ramage, S. W. Watterson, Joseph Back, Jay E. Latimer and H. A. Watterson.

RICHMOND, IND.—The city council has ordered the purchase of a garbage crematory. H. L. Weber is city engineer.

OAKLAND, CAL.—The board of public works received bids Sept. 10 for disposal of the garbage of the city for one year by cremation or otherwise. Louis Schaffer offered to cremate all the city's garbage for $450 a month. Another bid at the same figure was received, the garbage to be hauled to sea in scows, but the free use of the city wharf was asked. A. S. Tennent offered to haul all garbage by train and dispose of it outside of the city limits for $126 a week. The bids were referred to the city council.

STREETS AND ROADS.

NORFOLK, MASS.—Bids are asked by the Massachusetts highway commission until Oct. 1 for grading a road. Charles Mills, Ch. Engr., 15 Court Sq., Boston.

ANSONIA, CONN.—Bids are asked by the board of public works until Oct. 9 for about 3,000 sq. yds. of dimension block paving, and by the selectmen until Oct. 9 for constructing a pavement, as stated in our advertising columns. Engr., David C. Sanford, 87 Church St., New Haven, Conn.

EAST HARTFORD, CONN.—Bids are asked until Oct. 5 for constructing a macadam road. Chas. W. Roberts, Selectman, Silver Lane, Conn.

ELLINGTON, CONN.—Bids are asked until Oct. 1 for macadamizing a road. Address Erwin F. Miller, Selectman, Ellington.

ENFIELD, CONN.—Bids are asked until Oct. 3 for macadamizing a road. Address Geo. H. Payne, Selectman.

FARMINGTON, CONN.—Bids are asked until Oct. 5 for constructing a stone road 2,300 ft. long. E. H. Deming, Selectman.

MIDDLETOWN, CONN.—Bids are asked until Sept. 28 for constructing a telford macadam road. Martin Loveland, Selectman.

NEW MILFORD, CONN.—Bids are asked until Oct. 10 for macadamizing a road 5,000 ft. long. F. E. Starr, Selectman.

PLYMOUTH, CONN.—Bids are asked until Oct. 3 for macadamizing 2,800 ft. of road in Terryville. Henry E. Hinman, Selectman.

SEYMOUR, CONN.—We are informed that the bids for constructing a macadam road recently received by the selectmen were considered too high, and the contract was not awarded.

STAFFORD SPRINGS, CONN.—Bids are asked until Oct. 2 for macadamizing a road. Myron W. Leonard, Selectman.

ALBANY, N. Y.—Bids are asked until Oct. 7 for paving Canal St. with granite blocks; two sureties of $5,000 each. Thos. J. Lanahan, Clk. Bd. Contract.

BROOKLYN, N. Y.—Bids are asked until Oct. 1 for paving Manhattan Ave. with granite blocks, surety, $9,000; until Oct. 2 for repaving eight streets with asphalt, sureties, $1,200 to $6,750; and until Oct. 3 for paving Howard Ave. with cobblestones. Alfred T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until Oct. 4 for repaving two streets. R. G. Parsons, Secy. Dept. Pub. Wks.

DEPEW, N. Y.—Bids are asked until Oct. 1 for macadamizing and curbing Transit road, as stated in our advertising columns. John Graney, Chn. Com.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements until Oct. 2 for paving Melrose Ave. with granite blocks, Willis Ave. with asphalt, and for grading 160th St.; and by the department of public works until Sept. 30 for paving 10 streets with asphalt and two with granite blocks and relaying the pavement in Columbus Ave.

SYRACUSE, N. Y.—Bids are asked until Sept. 30 for grading Wood Ave. H. F. Stephens, Cy. Clk.

SYRACUSE, N. Y.—The council has received the following bids for paving Hanover Square: Asphalt.—John Dunfee, $32,672; Bermudez Paving Co., $40,369; Trinidad Asphalt Paving Co., $34,462; Warren-Scharf Asphalt Refining Co., $42,078; H. D. Grannis, $42,248; Fruin-Bambrick Construction Co., $33,201; Syracuse Improvement Co., $43,029. Vitrified Brick.—John Dunfee, $34,815; Homer & Co., $32,250; G. D. Grannis, $36,462. Sandstone block.—Homer & Co., $43,554; G. D. Grannis, $46,192.

JERSEY CITY, N. J.—Bids are asked until Oct. 8 for 3,700 sq. yds. of Belgian block paving in West Side Ave. Geo. T. Bouton, Clk. Bd. St. Comrs.

TRENTON, N. J.—Bids are asked until Oct. 1 for paving five streets with brick. C. E. Murray, Cy. Clk.

WOODBURY, N. J.—The freeholders of Gloucester county have decided to advertise for bids for constructing six miles of stone road from Westville to Glassboro, for which the director and county collector has been authorized to issue $20,000 in bonds.

PITTSBURG, PA.—Bids are asked until Sept. 27 for paving and grading portions of 17 streets. Edward M. Bigelow, Dir. Dept. Pub. Wks.

TURTLE CREEK, PA.—We are informed that W. A. Adams, 53 East Diamond St., Allegheny, has been awarded contracts for paving five streets, and McConegy & Burnett, of Greensburg, Pa., have been awarded contracts for paving seven other streets.

BALTIMORE, MD.—Bids are asked until Sept. 30 for paving Brevard St. Janon Fisher, Cy. Comr.——A resolution has been introduced authorizing the city commissioner to pave Aliceanna St. with Belgian blocks, at an estimated cost of $76,000.——Arrangements are being made to pave portions of 17 streets with sheet asphalt, brick, Belgian blocks, or asphalt blocks, at an estimated cost of over $400,000. Ordinances for this work were passed in 1893 and 1894, but have never taken effect.

MEMPHIS, TENN.—The council is considering the question of paving Beal St. with brick.

INDIANAPOLIS, IND.—Bids are asked until Oct. 5 for 1,943 sq. yds. of asphalt paving; until Oct. 12 for about 13,000 sq. yds. of asphalt paving and 7,630 sq. ft. of cement sidewalk; and until Oct. 15 for 13,000 sq. ft. of cement sidewalk.——Resolutions have been adopted for a brick sewer in Washington St. 2,565 ft. long, and for asphalting Liberty St., about 3,000 ft. long, the contracts for which will probably be let the last week in October. Chas. C. Brown, Cy. Engr.

NEENAH, WIS.—It is proposed to pave certain streets, at an estimated cost of about $12,000. T. T. Moulton, Cy. Clk.

BOONE, IA.—Bids are asked until Oct. 2 for paving certain streets. Bids were recently received for this work, but were all rejected. R. M. Mitchell, Cy. Engr.

KANSAS CITY, MO.—The following contracts have been awarded: Macadamizing Southwest Boulevard from the Belt line to the State line, 28,000 sq. yds., John Mahoney, $10,168; macadamizing Flora St., from 19th to 25th St., 10,916 sq. yds., A. J. Armstrong, $7,652; macadamizing Campbell St., from 16th to 18th St., 3,875 sq. yds., John Keating, $3,507.——The Southwest Boulevard is to be extended 16 miles through Rosedale to Olathe, Jackson county. E. G. Bartberger, of South Park, is interested.

BOZEMAN, MONT.—Bids are asked until Oct. 8 for constructing a road through the United States fish hatchery grounds at Bridger Canyon. Walter H. Sales, County Clk.

SACRAMENTO, CAL.—It is proposed to macadamize several miles of road and pave 1½ miles with bitumen. O. S. Flint, Cy. Clk.

MANUFACTURING PLANTS.

BURLINGTON, VT.—The Colchester Mills, at Winooski, are to increase their flooring by building a new mill 200 × 60 ft., 3 stories. F. C. Kennedy, Agent.

LAWRENCE, MASS.—Wm. S. Marsh, of Lawrence, has been awarded the contract for enlarging and repairs on two mills for the Washington Mills Co., to cost about $30,000.

SCHENECTADY, N. Y.—It is reported that the General Electric Co. is preparing plans and specifications for a new building, 92 × 350 ft., which will be used for an erecting and testing shop. This building will be of brick and steel construction, and will have two wide galleries running its whole length.

ELIZABETH, N. J.—Press reports state that H. Pritchard is preparing plans for the Elizabeth Tin Plate Co., which is to build works comprising roll mill, annealing room, store houses, power house, covering in all about 45,000 sq. ft.

WEEHAWKEN, N. J.—The Daniel Bermes Brewing Co., of Union Hill, is reported as preparing to erect a $60,000 building, to be used as a brewery. It will be brick, five stories above ground and two stories below the surface.

FRANKLIN, PA.—The Franklin Steel Casting Co., which was recently organized with $750,000 capital stock, has contracted with George W. Knopf for the erection of a plant to be built entirely of steel and corrugated iron. There will be three buildings, 45 × 170, 60 × 170, and 25 × 170 ft.

PATTON, PA.—It is reported that the stockholders of the Patton Clay Works will soon receive bids for the erection of the necessary buildings. Secy., E. C. Brown.

PHILADELPHIA, PA.—The plant of the Sunlight Oil & Gasoline Co., at 49th St. and Gray's Ferry Ave., was destroyed by fire on Sept. 19. The plant covered six acres, upon which were a warehouse, cooper shop, boiler and engine house and 15 tanks containing benzine and gasoline. The manager, Hiram Livesey, places the loss at $100,000, upon which there is but $4,000 of insurance.

PITTSBURG, PA.—It is reported that Capt. W. H. Moore, of this city, will erect a plant at Manown, a few miles above McKeesport, for the manufacture of tile brick for furnaces. This tile will be made from the slate above the coal vein, and will be taken from the Manown mines. The necessary machinery is now being purchased.

LYNCHBURG, VA.—The cotton mills at this place will put in a lot of new machinery at once.

COLERIDGE, N. C.—The Enterprise Mfg. Co. will put in a new electric plant at once.

DURHAM SHOALS, N. C.—A $200,000 cotton mill will be built and equipped at this place at an early date.

FRANKLINSVILLE, N. C.—The cotton mill buildings at this place are now being roofed, and will be equipped with modern machinery within the next 30 or 60 days, if the machinery can be bought and delivered in that time.

GREENSBORO, N. C.—Another new cotton mill company has been organized at this place, in which Messrs. Caesar Cone, of New York, and Rev. F. J. Murdock, of Salisbury, N. C., are largely interested. The mill will be equipped at once, the buildings having been erected some years ago. Secy., E. T. Garsen.

LINCOLNTON, N. C.—J. E. Duvall, of this place, has taken the contract to put in a 250-light electric light plant at the Lincolnton cotton mills, and will purchase necessary equipment to do so.

PROSPERITY, N. C.—N. D Woody and associates will build and equip a cotton mill of about 5,000 spindles capacity, at this place at an early day.

RAMSEUR, N. C.—The Columbia Mfg. Co. will enlarge its electric light plant and put in some new machinery.

ROCKWELL, ROWAN COUNTY, N. C.—John S. M. Miller, of this place, will build a roller flour mill, of 25-HP. capacity.

WELDON, N. C.—A company, with J. W. Wilson as president, has been organized at this place to build and operate a large cotton seed oil mill; capital stock, $30,000. Sec. and Treas., H. A. Mimms.

ROCK HILL, S. C.—The Globe, Arcade and Manchester cotton mills at this place are building additions, to be equipped with machinery, and in one case with electric light plant addition.

WINNSBORO, S. C.—A charter has been granted to the Fairfield Cotton Mills; incorporators, W. R. Doty, A. S. Douglass, T. K. Elliott, W. C. Beattie and others; capital stock, $75,000.

ATHENS, GA.—It is said that the Electric Cotton Mill Co. will arrange at once for commencement of work on its 10,000-spindle mill.

DOUGLASVILLE, GA.—The Eden Park Cotton Mills Co., it is said, will equip a plant of 3,000 spindles and make hosiery yarns its principal output; capital stock, $50,000, with privilege of doubling; Pres. and Mgr., Simon Baer, Cincinnati, O.; Vice-Pres., J. A. Pittman; Sec., Joseph S. James.

HARMONY GROVE, GA.—The Harmony Grove Cotton Mills at this place will double the capacity of the plant.

KNOXVILLE, TENN.—A press report states that the Brookside Cotton Mills' new addition will include a weaving room 380 × 128 ft., two stories high, to be filled with the latest improved machinery, and the plant's capacity will be quadrupled. About 400 more hands will be required for the new addition.

CLEVELAND, O.—It is reported that the Walworth Run Foundry Co. has completed negotiations for the purchase of land near New Brunswick, N. J., and work will soon be started on a number of buildings at that place.

CONNEAUT, O.—It is reported that J. W. Penfield & Sons, of Willoughby, are seeking a location in Conneaut, with a view to establishing a $25,000 brick plant.

GOODHUE, MICH.—A press report states that H. H. Nibbe is interested in the establishment of a brewery.

CHICAGO, ILL.—Francis J. Norton is reported to have completed plans for a factory at Bloomingdale road, to be built of mill construction. Plant will be 75 × 200 ft., five stories high, and will cost $75,000. Prof. Franks is the owner.

ROCKFORD, ILL.—The Rockford Cabinet Co.'s factory was destroyed by fire Sept. 21. Reported loss, $75,000; insurance, $40,000. The company will probably rebuild.

WALLA WALLA, WASH.—The Gilbert Hunt Mfg. Co. is reported as having in contemplation the erection of another building, to be erected after Jan. 1, 30 × 120 ft., of brick and iron.

SAN JOSE, CAL.—The planing mill of the Santa Clara Valley Mill & Lumber Co. was recently destroyed by fire. Reported loss on mill and lumber, $150,000; insurance, about $70,000

MISCELLANEOUS CONTRACTS AND SUPPLIES.

WATER TOWER.—Cincinnati, O.—Bids are asked until Oct. 5 for a portable water tower. D. W. Shedd, Secy. Fire Trustees.

FIRE ENGINE AND HOSE.—Elizabeth, N. J.—Bids are asked until Oct. 1 for furnishing a one-third size steam fire engine and 1,500 ft. of fire hose. James J. Manning, Cy. Clk.

TELEGRAPH WIRE.—Buffalo, N. Y.—Bids are asked by the fire commissioners until Sept. 30 for furnishing 60 miles of iron telegraph wire, 2,000 ft. of underground cable, and telegraph instruments.

REMOVAL OF WRECK.—Philadelphia, Pa.—Bids are asked until Oct. 4 for the removal of wreck of an unknown iron vessel lying in Delaware River at Bulkhead Bar. Maj. C. W. Raymond, U. S. Engr.

DRAINAGE CANAL WORK.—Chicago, Ill.—Bids are asked until Nov. 20 for constructing regulating works for the main drainage canal, as stated in our advertising columns. Thos. F. Judge, Clk. Sanitary District, Rialto Bldg.

LEVEE WORK.—Erie, Kan.—Contracts will be let in about 15 days for 100,000 cu. yds. of earthwork for levees along the Neosho River. About 30 miles of this leves have already been constructed. Frank H. Greene, County Surv.

DRAINAGE.—Yuba City, Cal.—Contracts will soon be awarded, according to reports, for constructing the Live Oak slough in the Live Oak Slough Protection District. Mr. Peck has been appointed engineer and superintendent of construction.

DRAINAGE CANALS.—Orlando, Fla.—Bids will soon be asked for about 64 miles of canals to drain a large tract of land in this state. Address W. W. Russell, P. O. Box 299, Orlando, Fla., or A. O. Russell, care of the U. S. Printing Co., Cincinnati.

MOVING STONE.—Cincinnati, O.—Bids are asked until Oct. 21 for moving about 6,000 cu. yds. of stone from Rock Shoal, on the Kentucky River, 4 miles below Beattyville, Ky., to site of lock No. 7 at High Bridge, Ky. Maj. James F. Gregory, U. S. Engr.

RIVER IMPROVEMENTS.—Richmond, Va.—Bids are asked until Oct. 12 for deepening and widening channel of James River, Va., and for construction and revetment of dikes and wing dams. For information apply to H. D. Whitcomb. Col. Peter C. Hains, U. S. Engr.

WATER FRONT IMPROVEMENTS.—New York, N. Y.—The department of docks is expected to commence work soon on important improvements of the North River water front. The work includes the construction of several piers 667 to 728 ft. in length and 80 ft. wide.

DISINFECTING PLANT.—Washington, D. C.—Bids are asked until Oct. 9 for all the labor and materials required in the erection of a disinfecting plant, including steam boiler, disinfecting chamber, pumps, sulphur furnace, fan, steam engine, etc., for the U. S. Quarantine Station at San Diego, Cal. Wm. Martin Aiken, Supervising Arch.

CANAL IMPROVEMENTS.—Albany, N. Y.—Geo. W. Aldridge, Supt. Pub. Wks., informs us that the following bids were received Sept. 12 for improving the Cayuga & Seneca Canal and Seneca Lake outlet:

E. H. Fleming & Co., Geneva, N. Y.	$10,042
Edward J. Hingston, Buffalo, N. Y.	12,322
Willard Johnson, Fulton, N. Y.	13,593

STATE CANAL WORK.—Albany, N. Y.—Bids are asked until Oct. 4 for the improvement of the Glens Falls feeder, between Glens Falls and Sandy Hill, N. Y.; also between the Maple and Pearl St. bridges in the village of Sandy Hill, N. Y.; also for improving Mud Creek and its tributaries in the towns of Lockport, Royalton, and Pendleton, in Niagara county. Geo. W. Aldridge, Supt. Pub. Wks.

CONTRACT PRICES.

CEMENT.—Washington, D. C.—Owing to a mistake of our Washington correspondent we stated last week that the New York & Rosendale Cement Co. bid 94¾ cts. per bbl. for American cement, to be delivered at Fort Washington and Fort Monroe. This company bid 99¾ cts. per bbl. to each place.

SEWERS.—Toledo, O.—The following bids were received by L. P. Harris, Cy. Clk., for a sewer in Whitney Ave., all the bidders being residents of Toledo:

Bidder.	20-in. brick.	Manholes.	Catch basins.	12-in. pipe.	15-in. pipe.	Extra sand, per cord.	Total.
W. H. & J. J. Leith	$0.88	$8.00	$35	$0.60	$0.90	$4.00	$1,408
J.F. & C.W.McKinney	.82	10.00	30	.47	.75	6.00	1,308
Geo. H. Bodette	.68	8.00	35	.30	....	5.00	1,119
W. J. McMahon	.75	8.00	30	.50	1.00	2.50	1,200
John Degnan	.73	8.50	45	.55	.75	3.00	1,240
H. P. Streicher	.80	10.00	30	.60	.70	5.00	1,287
G. H. Cole	.71	7.00	30	.40	1.10	3.50	1,137
H. J. Bower	.95	8.00	30	.50	.62	3.50	1,469
James Sheehan	.69	8.00	36	.40	.60	3.50	1,150

STREET CLEANING.—Indianapolis, Ind.—Bids were opened Sept. 19 for cleaning the asphalt and brick streets of the city for one year, the figure being the price for each cleaning of 10,000 sq. ft. of street. The city is divided into four districts. Fuehring Bros. bid 27 cts. on three districts, and 28 on the fourth. The Indianapolis Street Cleaning Co. bid 26 cts., 32½ cts., 30½ cts. and 31 cts. on the four districts, respectively. O. Girton bid 37 cts. on the second district. J. R. Kennington bid 33 cts. on the third district and 37 cts. on the fourth. Kennington bid the same for a three-year contract as for a one-year; Girton bid ½ ct. less, and the others 1 ct. less. The Indianapolis Street Cleaning Co. uses the Furnas pneumatic cleaner, and the others use machine brooms. Contracts are not yet awarded.

SUBWAY.—Boston, Mass.—B. Leighton Beal, Secy. Boston Transit Comm., informs us that the following bids were received Sept. 19 for constructing section 2 of the subway, as advertised in Engineering News; H. A. Carson, Ch. Engr.:

Bids Received Sept. 19, 1895, for Constructing Section 2 of the Boston Subway.

Quantities.		Edw. W. Everson, Providence, R. I.	John F. Dolan & Co., Elizabeth, N. J.	Jones & Meehan, Boston, Mass.	Woodbury & Leighton, Boston, Mass.	Richard A. Malone, Boston, Mass.	H. P. Nawn, Boston, Mass.	Metropolitan Const'n Co., Boston, Mass.
Excavation, elev. 92 to 110	3,060 cu. yds.	$1.00	$0.40	$2.00	$3.00	$1.15	$2.00	$3.00
" above elev. 110	51,000 " "	.50	.40	.00	.50	1.00	.85	.65
Surplus earth removed to Common	30,000 " "	.10	.50	.20	.20	.05	.30	.40
Removing surplus earth, ½ mile haul		.15	.20	.01	.35	.20	.40	.45
Removing surplus earth, each additional ½-mile		.05	.15	.01	.10	.10	.15	.11
Surplus earth, 1 mile average haul	17,000 cu. yds.	.25	.50	.03	.55	.40	.70	.67
Iron and steel work; setting and securing	1,150 tons	5.00	4.00	5.00	6.00	9.00	6.00	10.00
Iron and steel work; setting and securing	1,250 "	5.00	4.00	5.00	6.00	9.00	6.00	10.00
Brick masonry, American cement	100 cu. yds.	11.00	10.00	12.00	11.00	12.00	13.50	13.00
Brick masonry, Portland cement	800 " "	13.00	12.00	14.00	12.00	13.25	15.50	16.00
Concrete masonry, vert. comb. walls	1,300 " "	7.00	6.25	7.50	8.50	8.00	10.00	8.50
Concrete masonry, vert. comb. walls	1,900 " "	7.00	6.25	7.50	8.50	8.00	10.00	8.50
Concrete, Portland cement	7,000 " "	6.50	5.75	7.50	7.00	7.00	7.00	7.50
Concrete, Portland cement	8,400 " "	6.50	5.75	7.50	7.00	7.00	7.00	7.50
Basement stone masonry, Am. cement	100 " "	8.50	15.00	6.50	9.00	7.00	7.00	7.50
Basement stone masonry, Port. cement	1,400 " "	9.00	15.00	7.00	10.00	8.50	8.00	8.50
Granite footing stones	200 " "	25.00	30.00	30.00	30.00	30.00	30.00	35.00
Granite footing stones	250 " "	25.00	30.00	30.00	30.00	30.00	30.00	35.00
Spruce lumber in foundations	5,000 ft. B.M.	30.00	50.00	25.00	22.00	25.00	40.00	45.00
Waterproof coating	10,000 sq. yds.	.15	.50	.25	.50	.50	.40	.50
Total for stone		$127,700	$142,425	$142,585	$153,510	$168,025	$176,800	$179,595
Total for concrete[1]		124,200	129,475	143,285	149,310	165,925	175,400	178,385
Total for combined[2]		$121,050	$127,075	$139,285	$146,710	$163,325	$174,150	$175,515

[1] Total, substituting 1,400 cu. yds. additional of concrete, Portland cement, for the 1,400 cu. yds. of basement stone masonry, Portland cement. [2] Total, substituting 600 cu. yds. additional of concrete masonry, vertical combined walls, Portland cement; 100 tons additional of iron and steel work, setting and securing, and 50 cu. yds. additional of granite footing stones, in place of the 1,400 cu. yds. of basement stone masonry, Portland cement.

DRAINAGE DITCHES.—St. Paul, Minn.—The Red River Valley Drainage Commission has awarded the contracts for 177,000 cu. yds. of earth excavation from the Felton canal in Clay county, 106,000 cu. yds. from the Middle River ditch in Marshall county, and 35,000 cu. yds. from the Whiskey Creek ditch in Clay county, to McDonald & Kennedy, of Duluth, at 6.98 cts., 11½ cts. and 11¼ cts. per cu. yd., respectively, for the three contracts. Coughran & Riley, of St. Cloud, bid 7¼ cts., 15 cts. and 14 cts.; A. C. Reinhart, of East Grand Forks, Minn., 10½ cts., 13 cts., —; Geo. S. Barnes, of Fargo, N. Dak., 9 cts., —, —; W. J. Tierney & M. Tracy, of Grafton, N. Dak., 9 cts., —, —.

ASPHALT, BRICK AND STONE PAVING.—Syracuse, N. Y.—H. F. Stephens, Cy. Clk., writes us that the following bids were received Sept. 16 for paving West Onondaga St., from Delaware St. to Putnam St., with Trinidad sheet asphalt:

Bidder.	Excav.	Pav'g.	Orbg.	Prot'n curb.	Catch basin.	Total.
Fruin-Bambrick Co.	$0.40	$1.95	$0.85	$0.50	$55	$7,891
Warren-Scharf Co.	.50	2.60	.80	.50	80	10,094
Syracuse Imp'v't Co.	.40	2.38	.75	.45	80	9,471

The bids for about 13,000 sq. yds. of paving in Water, Warren and Genesee Sts. were as follows, the specifications calling for five-year guarantee:

SEWER BLOCKS.—Baltimore, Md.—The contract for 22,000 sewer blocks has been awarded to Shreve & Mollnard, at $2.15 per sq. yd. in place. The bids were received by Janon Fisher, Cy. Comr., Sept. 17, and were as follows:

Bidder.	per 1,000.
Shreve & Mollnard, Baltimore, Md.	$149.50
John L. Robertson, Baltimore, Md.	165.00
A. Weber & Co., Baltimore, Md.	168.00
F. A. J. Murphy, Baltimore, Md.	165.00
Westham Granite Co., Baltimore, Md.	152.00
McClenahan Bros., Port Deposit, Md.	*164.00
Guilford & Waterville Gr. Co., Baltimore, Md.	158.00

* Brice Alley, $164; Presstman St., $167.

SHELLS.—Jacksonville, Fla.—A contract for 12,000 bushels of oyster shells has been awarded to W. T. Garvin, the bids being as follows: W. W. Fisher, dead shell, at 6½ cts. per bushel; W. W. Frazer, live shell, 3½ cts., or delivered on dock at 4 cts.; W. R. Thompson, dead shell, 3¼ cts.; W. T. Garvin, dead shell, 3.72 cts., delivered on docks.

WATER-WORKS EXTENSION.—Niagara Falls, N. Y.—W. W. Read, Cy. Engr., has sent us a detailed statement of the bids received Sept. 13 for furnishing materials and making water-works extensions, as advertised in Engineering News. The bids for pipelaying were as follows:

Bidder.	16-in. pipe, 1,500 ft.	12-in. pipe, 2,808 ft.	8-in. pipe, 7,548 ft.	6-in. pipe, 24,000 ft.	4-in. pipe, 1,600 ft.	Rock excav'n, 500 cu. yds.
	cts.	cts.	cts.	cts.	cts.	
R. P. Slater	58	46	35	29	25½	$2.60
A. C. Douglas	48	40	34	30	25	3.00
Makin & Cookman	45	30	20	26	15	1.90
Jas. Watson & Son	58	45	35	30	20	2.50
*Rodgers & Ryan	31	26	21	17	15	2.00
Mike Sandro	50	40	30	25	20	1.50
Clement & Co.	34	27	21½	18	14	3.00
R. D. Young	38	29	23	21½	20	3.50

* Tonawanda, N. Y.; all others Niagara Falls.

LEAD PIPE.—Syracuse, N. Y.—The contract for 50,000 lbs. of A. A. A. 1½ to ½-in. lead pipe, as advertised in

Bids Received at Syracuse, N. Y., Sept. 16, for Paving with Asphalt, Brick or Sandstone Blocks.

Bidder.	Excavation, 2,000 cu. yds.	Embankment, 2,000 cu. yds.	Asphalt pvmt., 11,800 sq. yds.	Curbing, 3,400 lin. ft.	Protect'n curb, 825 lin. ft.	3-in. brick drain tile, 3,400 lin. ft.	Catchbasins, 2, Sketch D.	10-in. sewer pipe, 500 lin. ft.	Sandstone pvmt 325 sq. yds.	Scoria blk. pavement, 500 sq. yds.	Gutter stone, 3,400 lin. ft.	Catchbasins, 14, Sketch E.	Track inlets, 4, Sketch G.	Credit, cobble stones, 1,300 sq. yds.	Credit, sandstone blocks, 11,000 sq. yds.	Total.
Asphalt propositions:																
[1]John Dunfee, Syracuse, N.Y.	$0.60	$0.60	$1.80	$0.74	$0.45	$0.05	$75	$0.50	$3.00	$8.40	$0.60	$75	$25	$0.30	$0.30	$32,672
[2]Bermudez Paving Co., Syracuse	.45	.50	2.55	.70	.50	.04	65	.50	3.00	7.00	.65	75	15	.10	.30	40,368
[3]Trinidad Asphalt Ref. Co., N.Y.	.40	.50	1.95	.75	.50	.075	56	.40	2.80	6.60	.43	70	10	.10	.10	34,461
[3]Warren-Scharf Asph. Pvg. Co.,	.50	.50	2.60	.80	.50	.08	56	.60	3.05	7.50	.45	70	10	.20	.20	42,078
[4]G. D. Grannis, Syracuse, N. Y.	.30	.40	2.65	.70	.40	.03	63	.50	3.25	7.00	.50	60	11	.10	.10	42,278
[5]Fruin-Bambrick Const'n Co., N.Y.	.42	.42	1.95	.72	.43	.03	50	.35	2.30	6.00	.35	47	12¾	.05	.08	33,201
[3]Syracuse Improvmt Co., Syracuse	.40	.50	2.60	.75	.50	.04	90	.55	3.00	9.00	.65	75	15	.20	.20	43,028
Vitrified brick propositions:																
[5]John Dunfee, Syracuse, N. Y.	.30	.30	2.20	.65	.45	.04	76	.50	3.00	5.00	.....	74	40	.10	.10	34,815
[5]Homer & Co., Olean, N. Y.	.30	.50	2.13	.58	.30	.05	52	.50	4.00	5.75	.....	55	13½	.25	.27	32,250
[6]G. D. Grannis, Syracuse, N. Y.	.30	.40	2.25	.70	.40	.03	63	.50	3.25	7.00	.....	60	11	.10	.10	36,462
Sandstone block:																
Homer & Co., Olean, N. Y.	.30	.50	3.19	.60	...	.05	52	.50	....	....	.....	55	15	.10	.25	43,554
G. D. Grannis, Syracuse, N. Y.	.30	.40	3.25	.70	...	.03	63	.50	....	....	.....	60	11	.10	.10	46,192

[1] Alcatras asphalt. [2] Bermudez asphalt. [3] Trinidad asphalt. [4] Standard asphalt (California). [5] New York Brick & Paving Co. brick. [6] New Cumberland, W. Va., brick.

SEWERS.—Indianapolis, Ind.—Contract was let Sept. 21 for sewer in alley east of Broadway to Capital Paving & Construction Co., at $1.62 a lin. ft., other bids being $2.15, $2.32, $1.73 and $1.95. The sewer is 1,995 ft. long, and has 649 ft. of 24-in. pipe, 692 ft. of 20-in., 654 ft. of 15-in., 637 ft. of 6-in. house connections, 6 manholes, 1 lamphole and 1 flushtank. Contracts were let Sept. 17 for sewer in Capitol Ave. to W. R. Mercer & Co., at $4.47 a lin. ft., other bids being $4.75, $4.79, $4.84, $5.09, $5.23, $5.24 and $5.31. The sewer is 8,092 ft. long, and has 635 ft. of 50 × 75-in. 2-ring brick, 830 ft. of 48 × 72-in., 1,370 ft. of 44 × 66-in., 645 ft. of 46 × 69-in., 590 ft. of 42 × 63-in., 505 ft. of 40 × 60-in, 1,460 ft. of 38 × 57-in., 644 ft. of 36 × 54-in., 656 ft. of 34 × 51-in., 647 ft. of 32 × 48-in., 4,000 ft. of 6-in. pipe house connections, 27 catchbasins and 24 manholes. Contracts have also been let for sewer in alley east of Ash St. to Gansberg & Roney, at $1.26 a lin. ft., other bids being $1.57, $1.79 and $1.92. The sewer is 1,265 ft. long, and has 642 ft. of 18-in. pipe, 623 ft. of 12-in., 380 ft. of 6-in. house connections, 4 manholes, 1 lamphole and 1 flushtank. Also for

Engineering News, has been awarded to Pierce, Butler & Pierce, of Syracuse, at $3.59½ per 100 lbs. The other bidders were Charles Millar & Sons, Utica, $4.20; E. W. Blatchford & Co., Chicago, $4.18; N. O. Nelson Mfg. Co., St. Louis, $4.05; Standard Mfg. Co., Pittsburg, $4.05.

CEDAR BLOCK PAVING.—Oshkosh, Wis.—Florian Lampert, Cy. Comptroller, has sent us the following statements of the bids received Sept. 16 for paving with cedar blocks:

Bidder.	Paving, 8,884¾ sq. yds.	Curbing, 4,053 ft.	Grading, 3,943 cu. yds.	Total.
H. S. Wood	.....	$0.29¾	.....	.....
Wells, Reichert & Co.*	$0.62½	.31	$0.17	$7,481
John Martin	.62¾	.28½	.16	7,362
Charles Ripe	.....	.31	.....	.....
James Fife	.61½	.43	.30	7,506
		.32	.16½	
			24¾	
Frank Brennand	.....	.....	.....	.....
Alexander Gallagher	.63	.28	.20	7,521

* Appleton, Wis.; all others, Oshkosh.

BRICK PAVING.—Jacksonville, Fla.—The contract for paving Market St. has been awarded to Geo. R. Foster, at $1.40 a sq. yd. for brick manufactured by the Virginia Paving & Construction Co., of Chilhowie, Va.

SEWERS.—College Point, (L. I.), N. Y.—Chas. Fuohs, Engr. and Comr. of Sts., writes us that the following bids were received Sept. 16 for constructing sewers:

Quantities.	T. R. Sullivan College Pt. L. I.	L. Collins, Whitestone, L. I.	Pece Bros., Flushing.	T. F. Tuohy & Fitzpatrick, Flushing.
30-in. brick .....857.8 ft.	$3.25	$3.235	$4.14	$3.49
30-in. " .....768.0 "	3.00	2.85	3.64	3.34
24-in. cement pipe ..487.5 "	2.00	1.85	2.39	2.40
18-in. " " .. 10.0 "	1.00	1.20	1.79	1.60
15-in. " " .. 10.0 "	.80	.95	1.59	1.45
12-in. round cem. pipe484.0 "	1.25	.80	.95	.95
6-in. vitrified pipe..500 "	.30	.30	.25	.24
Basins 2	120.00	79.00	128.00	110.00
Reconst'g old basins.14	50.00	10.00	16.00	20.00
Manholes 5	50.00	23.00	34.50	27.00
Rebuild'g old manhls. 1	30.00	5.00	10.00	10.00
Junction chambers .. 2	20.00	3.00	9.50	15.00
Rock excavation, per cu yd...	4.50	5.00	2.50	3.00
Timber	....	11.75	....	15.00
Total	$8,101	$6,804	$8,817	$8,032

BRICK PAVING.—Chester, Pa.—Jas. B. Campbell, Cy. Clk., writes us that the contract for brick paving, for which bids were opened Sept. 16, has been awarded to W. E. Reilley, of Chester, Pa., at $1.80 a sq. yd. for Savage brick.

WATER-WORKS EXTENSIONS.—St. Louis, Mo.—We are informed that the following bids were received Sept. 17, all the bidders being residents of St. Louis: (These are probably the lowest and successful bids.—Ed.)

Howard-Harrison Iron Co.:	
950 tons of 20-in. cast iron coated pipe, at $22.47	$21,346
5,400 tons of 30-in. cast iron coated pipe, at 22.47	121,338
Total	$142,684
Todd Pulley & Shafting Wks:	
120 tons of c. i. coated special castings at $36.90	$4,428
St. Louis Iron & Machine Works:	
50 6-in. stop valves .....at $13.00	$650
10 20-in. " " ..... " 120.00	1,200
10 30-in. " " ..... " 480.00	4,800
Total	$6,650
Flueger & Henger Mfg. Co.:	
150 single nozzle post fire plugs.....at $21.00	$3,150
R. J. MacDonald & Co.:	
Laying 20,700 lin. ft. 30-in. water pipe..at $0.82½	$17,077
" 200 " " 12-in. " " " " .15	30
" 800 " " 6-in. " " " " .15	120
Setting 14 fire plugs 2.50	35
Furnishing 700 lbs. wrought iron ..... .03	21
Plate girder box 9.00	900
Total	$18,183
Geo. D. Prendergast:	
Laying 3,300 lin. ft. 30-in. water pipe....at $0.85	$2,805
" 11,000 " " 20-in. " " .... " .49	5,390
" 50 " " 12-in. " " .... " .30	15
" 600 " " 6-in. " " .... " .20	120
Taking up 5,900 lin. ft. of 6-in. water pipe " .01	59
Setting 30 fire plugs ..... " 5.00	150
Furnishing 650 lbs. wrought iron..... " .06	39
Total	$8,578

BRICK PAVING.—St. Joseph, Mich.—Albert A. Potter, Cy. Clk., writes us that the contract for paving with brick on 6 ins. of gravel, as advertised in Engineering News, has been awarded to Thomas J. Peter at $1.04 per sq. yd. for Clinton brick. The bids were as follows:

Bidder.	Curbing.	Grading.	Brick.
J. H. Flagg, City Hall, Chicago..	$0.30	$0.26	$1.13 to $1.25
Burns & Eason, Chicago	.35	.35	1.25 " 1.34
Cosgrain & McDonald, Chicago....	.35	.40	1.16 " 1.29
Chicago Pav'g Supp. Co.,Chicago	.37	.31	1.12 " 1.18
T. J. Peter, Tacoma Bldg.,Chicago	.30	.25	1.04 " 1.21
Mr. Luchtenberg, Columbus, O...	.33	.30	1.18 " 1.28
Patrick Dee, Detroit, Mich.....	.40	.25	1.30
John J. Granville, Saginaw E. S.	.33	.23	1.18 " 1.22
W. W. Nelson, South Bend, Ind...	.20	.24	1.17 " 1.19
Peterson & Co.,W.Bay City,Mich.	.32	.18	1.03 " 1.13
So. Bend Const'n Co.,So. Bend,Ind.	.30	.17	1.16 " 1.29
Thos. A. Walker, St. Joseph,Mich.	.30	.30	1.35
Pearl & Co., Benton Harbor, Mich.	.66	.33	1.11

WATER-WORKS.—Milford, Mich.—Geo. P. McCoy, Cy. Clk., writes us that the contracts for water-works were awarded as follows: Two pumps, 1,500,000 gallons, Henry R. Worthington, $1,692.50; two boilers, 60 ins. × 16 ft., Arbuckle & Ryan (Russell), $1,994; pipe, Michigan & Peninsular Car Co., $22.75 per ton, and special castings at 2¼ cts. per lb.; valves and hydrants, Michigan Brass & Iron Works, 8-in. valves, $15.50, 6-in. $10, 4-in. $6.50; valve boxes, $2.45; hydrants, $21.85; pipe-laying, H. Merigold, Lima, O., 8-in. 15 cts.; 6-in., 13 cts.; 4-in., 10 cts.

MACADAMIZING.—North Haven, Conn.—David C. Sanford, Engr., New Haven, Conn., received the following bids, Sept. 19, for macadamizing in this town, the price being per lin. ft. for an 18-ft. roadway:

	8 ins. macadam.	16 ins. telford.
John Doolittle & Co., New Haven.....	$2.25	$2.50
A. Brazor & Son, New Haven.....	1.60	2.00
* Lawrence Bruce, North Haven.....	1.29	1.49

* Awarded contract

BOILERS AND STAND-PIPES.—Somersworth, N. H.—The following bids were received Sept. 16; Engr., Wm. Wheeler, 89 State St., Boston:

Boilers (specifications pub. Sept. 12).		Smoke flue, per ft.
Scannel & Wholy, Lowell, Mass.....$1,530		$2.35
Charles Riv. Ir. Wks., Cambridge, Mass. 1,410		3.21
D. M. Dillon, Fitchburg, Mass..... 1,980		2.40
Atlantic Works, Boston..... 1,480		2.50
Strather, Wells Co., Warren, Pa..... 1,533		2.38
Buerkel & Co., Boston 1,376		3.45
Roberts Iron Works, Cambridgeport.. 1,425		3.25
Bigelow Co., New Haven, Conn..... 1,733		3.75
*E. Hodge & Co., East Boston..... 1,245		2.75
Stand-Pipe (40 ft. × 90 ft.).		Drilled bolt holes, extra.
E. Hodge & Co., East Boston $15,995		$1,200
*Strather, Wells Co., Warren, Pa.. 12,238		125
Walch's Holyoke St'm B'l'r Wks.** . 12,479		...

* Awarded contracts. ** Holyoke, Mass.

INDUSTRIAL NOTES.

THE LENOIR CAR WORKS, Lenoir, Tenn., has an order for 500 freight cars for the Southern Ry.

SUTHOFF BROS., of Flemington, N. J., have the contract for sinking an artesian well at Passaic, N. J.

WRIGHT BROS., of Iron Mountain, Mich., have the contract for 500,000 ties for the Chicago, Milwaukee & St. Paul Ry.

W. S. FOSTER, of Mobile, Ala., has the contract for an iron and wood machine shop, 50 × 150 ft., for the Mobile & Birmingham R. R.

THE RHODE ISLAND LOCOMOTIVE WORKS, of Providence R. I., is building 6 engines for the New York & New England R. R., and 5 for the Boston & Maine R. R.

THE SHARON IRON WORKS, of Sharon, Pa., has purchased the rolling mill at Danville, Pa., and will operate it in connection with the Sharon plant, with Irwin Hyde in charge.

THE UNION SWITCH & SIGNAL CO., of Swissvale, Pa., has furnished the interlocking apparatus for the crossing of the Western Indiana R. R. and the Belt Line R. R. at Chicago.

THE FLEMING CEMENT & BRICK CO.'S plant was sold at auction in New York on Sept. 24, by order of the Supreme Court. Freeman & Greene, 280 Broadway, are attorneys for the receiver, R. S. Kuhl.

THE E. R SOUTHERN IRON CO., of St. Louis, Mo., has an order for 60 tons of pipe, roofing and siding for a smelter, to be erected by the Menerio Promontoric syndicate in the state of Durango, Mexico.

THE GOULD COUPLER CO., of Buffalo, N. Y., has orders for its automatic couplers and buffers for passenger cars for the London & Southwestern Ry. and London, Brighton & South Coast Ry.

THE AMERICAN CAR CO. AND THE ST. LOUIS CAR CO., of St. Louis, Mo., are reported as to be consolidated, with a capital stock of $1,000,000. Both companies build principally cars for street railways.

THE BULLEN BRIDGE & CONSTRUCTION CO., of Pueblo, Colo., and Portland, Ore., has the contract for a steel highway bridge across the Fraser River at New Westminster, B. C., which will cost about $400,000.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, Pa., has orders for three locomotives for the Guatemala Central Ry., one for the Central R. R. of Georgia, and two for the Mobile & Birmingham R. R.

THE ROGERS LOCOMOTIVE WORKS, of Paterson, N. J., has orders for 10 mogul engines and 2 suburban tank engines for the Illinois Central R. R., and 3 eight-wheel engines for the Florida Central & Peninsular R. R.

THE RAILROAD SUPPLY CO., Owings Building, Chicago, announces that since it obtained complete control of the business of the National Surface Guard Co., extensive orders have been received for National cattle guards.

THE ECLIPSE SWITCH & SIGNAL CO., formerly of Beaver Falls, Pa., has removed to new and more extensive works at Elmira, N. Y. Its three-position semaphore signal was described in our issue of Dec. 20, 1894.

THE LAIDLAW-DUNN-GORDON CO., of Cincinnati, O., has sent out notices to all its branch houses and agents throughout the country, advancing prices 15%, and instances this as an indication of better times in the pump business.

THOMPSON & GRAY, of St. Louis, Mo., have the contract for broken stone ballast on 185 miles of the St. Louis Division of the Missouri, Kansas & Texas Ry., and also for masonry abutments and piers for 10 bridges on that division.

THE PENN BRIDGE CO., of Beaver Falls, Pa., has a contract from the Second Ave. Traction Co., of Pittsburg, for the ironwork at the viaduct to be placed over a railway crossing at Dravosburg. The price is stated to amount to $75,000.

THE GLOBE IRON WORKS CO., of Cleveland, O., is building a steam revenue cutter for the U. S. Treasury Department, the contract price for which is $147,800, and is also building a freight steamer 415 ft. long, with a capacity of 5,500 tons, to cost $275,000.

THE TABOR MFG. CO., of New York, builders of automatic foundry molding machines, has recently been reorganized with the following officers: President, Harris Tabor; Vice-President, Angus Sinclair; Secretary, E. H. Mumford. The office is at 39 Cortlandt St., New York city.

C. L. STROBEL, The Monadnock, Chicago, has been awarded the contract for the ironwork for the Century Building, Olive, Ninth and Locust Sts., St. Louis, Mo. It is to be a 10-story and attic office and theater building, 228 × 127 ft. About 2,000 tons of steel will be required, and a considerable amount of cast iron work. The front will be of Georgia marble.

F. R. DRAVO & CO., Lewis Block, Pittsburg, Pa., have a contract for two 300-HP. tandem compound condensing Ball engines, to be directly coupled to Westinghouse generators, for the new works of the Apollo Iron & Steel Co., at Vandergrift, Pa. The principal forgings are of special high carbon steel. The main shafts will be 14 ins. diameter.

THE BRUCE ERECTING CO., Lewis Block, Pittsburg, Pa., has a force of men engaged in erecting a 70-ton traveling crane, made by the Industrial Works, Bay City, Mich., in the plant of Jones & Laughlins, on the South Side, and in tearing down the old stacks and erecting a number of Cook boilers in the plant of the Pittsburg Iron & Steel Mfg. Co., Soho.

WILLIAMS, DOUGHERTY & UPHAM, of Duluth, Minn., have been awarded the contract for doing the dredging of the new Mesaba ore dock at Duluth, for the Duluth, Mesaba & Northern R. R. When completed, the slip will be 100 ft. wide. Mr. Williams informs us that one dredge is already at work, and that another one is to be put to work as soon as possible.

THE PETERSBURG IRON WORKS CO., of Petersburg, Va., has been awarded the contract by the U. S. government for furnishing a lot of I-beams, steel bolts and plates for use at Fort Washington, Md., and Fort Monroe, Va. It is also building for the government a snagboat for use on Roanoke River, N. C. In addition, it is doing a considerable amount of repair work and is building a number of steam engines.

MOHN & HOFF, of Association Building, Chicago, Ill., have been awarded the contract for two additional stories on the Major Block, Chicago. They inform us that work is progressing on other contracts on hand, among them the ironwork for Cook county jail, Chicago, and the ironwork for the new buildings of the Parrott Silver Mining Co., of Butte, Mont.; R. Schenck, C. E., Chicago, is the Consulting Engineer for the latter.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has the contract for an interlocking signal plant on the Gibbs system (Eng. News, Feb. 22, 1894), for four crossings of the North Chicago St. Ry. with the Chicago, Milwaukee & St. Paul Ry. The company has also the contract for two large interlocking plants at Springfield, Ill., where the Chicago, Peoria & St. Louis R. R. crosses the Illinois Central and Wabash railways.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, Pa., has acquired the Bradbury-Stone Co., of Lowell, Mass., and has a contract for a battery of 140 chloride cells, discharging at the rate of 100 amperes for three hours, to assist the generating plant of the Edison electric station at Lawrence, Mass., during the times of heavy load. The company is also equipping street cars for service in New York.

THE GLOBE IRON WORKS, Dayton, O., has furnished the entire water wheel equipment for the Sault Ste. Marie Pulp & Paper Co., of Canada, including 48 water wheels in horizontal iron flumes. The works are to be enlarged by the construction of a paper mill and a sulphite mill on the Canadian side and general mills on the American side. Water power from Lake Superior valued at $2,375,000 is in possession of the company.

POST & FLOTO, of New York, are introducing a new brownprint sensitized paper, producing either white lines on a brown background or brown lines on a white background, and it is said that copies can be made in much shorter time than with the ferroprussiate or ferrogallic papers, while a special property claimed for it is that good copies with sharp lines can be made direct from drawing paper or cardboard, provided they are white and clear.

THE WAKEFIELD SHEET PILING CO., 1637 The Monadnock, Chicago, informs us that its triple-lap sheet piling has been specified in the specifications prepared by Major W. L. Marshall, U. S. A., for the proposed lake front improvements at Chicago. The bulkhead along the dock line will require about 14,000 ft., in connection with the building of the sea wall. Bids for this work were received by John F. Wallace, M. Am. Soc. C. E., Chief Engineer, Illinois Central R. R., Sept. 17.

THE F. D. CUMMER & SON CO., of Cleveland, O., manufacturing dryers for drying ore, terracotta, bricks, cement, grain, fertilizers, etc., report the following among its recent orders: One continuous gypsum calciner to J. Thomlinson & C. F Beebe, Portland, Ore.; one sand dryer and heater, capacity 200 tons per day, to Hugh Murphy, Omaha, Neb.; one dryer for drying concentrates to the Smuggler Union Mining Co., Telluride, Colo., and one tankage dryer to the Peet Bros. Mfg. Co., of Kansas City, Mo.

THE ROCKFORD CONSTRUCTION CO., of Rockford, Ill., has just completed a contract for 5,000 yds. of brick paving at Muscatine, Ia., and a contract for about 1½ miles of sewer at the same place. It is now laying about 30,000 yds. of brick paving at Waukegan, Ill., and has contracts at De Kalb and Dixon, Ill., for the same class of paving. It has also under contract a small water-works system at Algonquin, Ill., where the water is to be raised to a brick reservoir about 150 ft. above the village by two hydraulic rams of special construction.

THE KENWOOD BRIDGE CO., of Chicago, Ill., Paul Willis, Chief Engineer, has recently been awarded the contract for furnishing the ironwork for the new car house of the Lake St. Elevated R. R., at West 40th St., Chicago. It will be about 400 × 70 ft. It also has the contract for some plate girder work for the Illinois Central Ry., and is furnishing several roofs for the new buildings of the Universal Gas Co., of Chicago, two of which are 86 × 270 ft., and 96 × 250 ft., respectively. It has recently completed two small highway bridges at Lake Forest, Ill., of which W. L. Stebbings, 1118 The Monadnock, was the chief engineer.

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